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U.S. Department of the Interior
Bureau of Land Management

Medford District Office
Ashland Resource Area
3040 Biddle Road
Medford, Oregon 97504

January 2000

Klamath-Iron Gate Watershed Analysis

Version 1.1

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering the wisest use of our land and water resources, protecting our fish and wildlife, preserving the environmental and cultural values of our national parks and historical places, and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to assure that their development is in the best interest of all our people. The Department also has a major responsibility for American Indian reservation communities and for people who live in Island Territories under U.S. administration.

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I

Klamath-Iron Gate Watershed Analysis

Version 1.1

Bureau of Land Management, Medford District
Ashland Resource Area

January 2000

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EXECUTIVE SUMMARY

Introduction

Watershed analysis is the primary tool for generating information to implement ecosystem management as directed in the Northwest Forest Plan and the Medford District Resource Management Plan. The Klamath-Iron Gate Watershed Analysis describes conditions and interrelationships of ecosystem components for the Klamath-Iron Gate Watershed. The analysis focuses on issues and key questions that are most relevant to the management questions, human values, and resource conditions within the watershed. Management objectives and recommendations for BLM-administered lands are prioritized based on conclusions reached through the analysis. The watershed analysis formulates an overall landscape plan and recognizes the inventory, monitoring, and research needs for the watershed.

The Klamath-Iron Gate Watershed Analysis was prepared by an interdisciplinary team of resource professionals and specialists from the Bureau of Land Management (BLM) Ashland Resource Area and Medford District Staff. Some information regarding the California portion of the watershed was provided by the BLM Redding Field Office. The watershed analysis team followed the six-step process outlined in the *Ecosystem Analysis at the Watershed Scale, Federal Guide for Watershed Analysis, version 2.2.* The six steps or sections included in the Klamath-Iron Gate Watershed Analysis are: 1) characterization, 2) issues and key questions, 3) current conditions, 4) reference conditions, 5) syntheses and interpretation of information, and 6) recommendations.

The Klamath-Iron Gate Watershed Analysis addresses the entire analysis area and is based on existing information and recent data collection. Where resource information is missing, a data gap is identified. The watershed analysis process is iterative and new information will be used to supplement future versions of the analysis.

Public participation for the Klamath-Iron Gate Watershed Analysis included two public meetings in April 1999 and the opportunity to submit written and/or verbal comments. Approximately 1,200 notices regarding the open houses were sent to residents within the analysis area, people who had previously submitted comments regarding the Cascade/Siskiyou Ecological Emphasis Area Plan, local agencies, local groups, and the Klamath Tribe, the Quartz Valley Indian Reservation, the Cow Creek Band of Umpqua Indians, and the Confederated Tribes of Siletz and Grand Ronde. The notice provided a map of the area, explained watershed analysis, and included a comment form for people to mail if they couldn't attend the open house. The first open house was held at Bogus Elementary School in Montague, California and the second was at the U.S. Forest Service's Ashland Ranger District Office in Ashland, Oregon. The Ashland open house was for both the Klamath-Iron Gate and Upper Bear Creek Watershed Analyses. The purpose of the open houses was to give the public the opportunity to share with the watershed analysis team their ideas, concerns, information regarding the historic or current conditions, and recommendations on how the watershed should be managed.

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Watershed Characterization

The Klamath-Iron Gate Watershed covers approximately 66-square miles (42,360 acres) within the Upper Klamath River Subbasin. The watershed is located at the intersection of the Klamath Mountains and the southern Cascade range and extends from the ridge between Soda Mountain and Pilot Rock in the north to the Iron Gate Reservoir in the south. It includes Scotch Creek to the west and Fall Creek to the east, but does not include Jenny Creek. The watershed includes land in both Oregon and California.

Land ownership within the Klamath-Iron Gate Watershed includes: Bureau of Land Management (18,075 acres), State of California (4,063 acres), and private lands (20,222 acres). Federal land use allocations include: Matrix, Riparian Reserves, District Defined Reserves, Special Areas (Pilot Rock Area of Environmental Concern, Scotch Creek Research Natural Area, Bean Cabin Recreation Site, Horseshoe Ranch Wildlife Area, Pokegama Wild Horse Management Area and Cascade/Siskiyou Ecological Emphasis Area), a Special Recreation Management Area (Pacific Crest National Scenic Trail), and a Wilderness Study Area (Soda Mountain).

Regional public issues reflect the dominant uses of the watershed and include: concerns with off-highway vehicle use; grazing and timber harvest on public lands; concerns over general degradation of the natural environment; concerns about fish and water quality; and concerns regarding Siskiyou/Cascade ecological linkages. Public concerns more specific to this watershed include: land acquisition for Horseshoe Ranch and management of the Ranch for deer winter range; Schoheim road; the spread of noxious weeds; the Soda Mt. land exchange; access concerns (both by those wanting limited access and those wanting unlimited access); closing roads to prevent wildlife harassment and keeping roads open to provide access for fire suppression; and concerns over private property rights.

The Klamath-Iron Gate Watershed is characterized by mild, wet winters and hot, dry summers. The lower elevations of the watershed are classified as having a low severity fire regime with frequent, low intensity fires, while the mid-elevations and drier portions of higher elevations have a moderate fire regime with less frequent fires and varying intensity.

The Klamath-Iron Gate Watershed lies mainly within the Western Cascade Subprovince of the Cascade Mountain Geologic Province. The terrain within the watershed consists of steep hillsides and flat valley bottoms. The steeper slopes are subject to mass soil movement during rain-on-snow or intense storm events.

The northern portion of the watershed is dominated by forest lands intermixed with large patches of shrublands and woodlands and some grasslands. Tree species in the northwest portion of the watershed are predominantly Douglas-fir and white fir or incense cedar with sugar pine and ponderosa pine scattered throughout. Douglas-fir and ponderosa pine dominate the northeastern portion with some incense cedar and white fir. The southern portion of the watershed is composed of juniper, shrubs, and grasses. There are 13 populations (three species) of special status vascular plants known to exist within the watershed and four sites (three species) of Survey and Manage plants. Noxious weed species known to occur within the watershed include St. Johnswort (Klamath weed), yellow starthistle, and medusahead wildrye. Other non-native species that have

been seen in the Klamath-Iron Gate Watershed are ripgut brome, cheatgrass, bulbous bluegrass, and hedgehog dogtail.

Northern spotted owls and bald eagles, both listed as threatened, are present in the watershed. A portion of the watershed is in a northern spotted owl critical habitat unit. Nineteen special status wildlife species are known or are likely to be present in the watershed. The watershed supports deer winter range.

The section of the Klamath River within the watershed (from Iron Gate Dam to Copco Dam) is the only water body within the watershed that is listed as water quality limited. The Klamath-Iron Gate Watershed provides spawning and rearing habitat for several resident fish species, including rainbow trout, redband trout, and Klamath smallscale sucker. Iron Gate reservoir contains a variety of fresh water and warm water game fish as well as several non-game fish species.

Human Uses

Two radically different patterns have characterized land use in the Klamath-Iron Gate Watershed. For thousands of years, indigenous people followed a hunting-fishing-gathering way of life, based on a small-scale, subsistence-oriented economy. Approximately 150 years ago, the advent of Euro-American settlement brought fundamentally different land use patterns based on complex technologies and an economic system connected to global markets.

The last 150 years have contributed to substantial changes in the landscape of the watershed. In the nineteenth century, newcomers introduced a host of new plant (agricultural crops and weeds) and animal (farm and ranch animals) species; plowed under native meadows for farms and degraded grasslands and prairies through unregulated grazing; dammed and diverted streams for irrigation; logged the more accessible timber stands (especially sugar pine); and hunted unwanted predators (grizzly bears and wolves) and other species (antelope and bighorn sheep) to local extinction. In the twentieth century, hydroelectric power has changed the landscape and hydrology through construction of several dams and reservoirs, and the federal government has taken an increasingly active role in managing the lands. Logging has expanded with the post-World War II development of roads and improvements in transportation; fire suppression has affected the local vegetation; and a host of state, federal, and local policies guide human operations on both public and private lands.

The effects of these actions are written on the land: the hydrology and fisheries of the watershed have been altered through water withdrawals, dams, roads, and other actions; erosion is more severe in some places than in the past; soil productivity has been affected in some areas by compaction, hot fires, and changes in vegetation patterns; vegetation patterns have been altered through fire suppression, logging, grazing, and other actions; topography has changed in places through the construction of roads, dams, and stream alterations; and native species (plants and animals) have disappeared or become reduced as a result of a number of processes including early unregulated hunting and grazing and through competition with non-native species.

The advent of ecosystem management suggests a shift from an extractive perspective to one combining economic concerns with stewardship practices. Given the high percentage of watershed

land under federal management, federal land management policies will continue to have a significant effect in the watershed.

Terrestrial Ecosystem

Fire suppression, plant succession, logging, road building, vegetation conversion for agricultural uses, livestock grazing, and the introduction of non-native plants are the main processes that have designed the landscape since the turn of the century. Results stemming from these processes include: increased forest stand density with a low level of growth or vigor; increased susceptibility of forest stands to bark beetle attacks and pathogens; a change in the species composition and structure of forest lands, grasslands, shrublands, and oak woodlands; and habitat alteration of shrublands, oak woodlands, and savannahs. These changes have caused an increase in fire hazard and a shift in the intensity and effects of wildfires when they occur. Current trends in silvicultural and prescribed fire practices are focusing on restoring and maintaining vegetative communities to a more fire resilient, native vegetation condition.

Vegetative conditions are the primary influence on terrestrial wildlife/animal populations and their distribution within the watershed and across the greater landscape. Declines in mature/old-growth habitat and the quality of early and mid-seral conifer, oak woodland, shrubland, and grassland habitat have likely contributed to the decline of populations of wildlife species that prefer these habitats. The decrease in mature/old-growth habitat is likely to have resulted in lower populations of northern spotted owl and some special status species. Poor winter range forage conditions may limit the size of the interstate deer herd.

Aquatic Ecosystem

The streamflow regime reflects human influences that have occurred since Euro-Americans arrived. Road construction, timber harvest, land clearing, dams, and water withdrawals are the major factors having the potential to adversely affect the timing and magnitude of streamflows in the Klamath-Iron Gate Watershed.

Channel conditions and sediment transport processes in the Klamath-Iron Gate Watershed have changed since Euro-American settlers arrived in the 1830s primarily due to logging, road building, livestock grazing, and removal of riparian vegetation. Stream channel complexity and stability have been reduced resulting in poorer quality habitat for aquatic species and an increased susceptibility to streambank erosion.

Roads and riparian vegetation removal through logging, livestock grazing, or residential clearing are the primary factors that have adversely affected water quality in the Iron Gate Reservoir tributaries. Water quality concerns in the Klamath River are attributed to dam construction/operation, flow regulations/modification, water diversions, habitat modification, nonpoint sources, municipal point sources, irrigated crop production, and agricultural return flows. Water quality parameters known to be affected by these human disturbances are temperature, sediment, and turbidity in the tributaries to Iron Gate Reservoir and temperature, dissolved oxygen, and nutrients in the Klamath River and Iron Gate Reservoir.

Natural and human-caused events that have altered stream channels and water quality have affected riparian habitat as well. Some of the results are fragmented connectivity of riparian habitat; reduced quantity of snags and large woody material; reduced streambank stability; increased sediment production to streams; and reduced stream shading with an added impact of higher stream temperature. Riparian Reserves along intermittent, perennial nonfish-bearing, and fish-bearing streams will help to provide a future long-term source of large woody material recruitment for streams on federal lands.

Since the construction of Iron Gate Dam on the Klamath River, anadromous fish (particularly steelhead) no longer have access to the river above that point or to upstream tributaries. Trout that have become established in the reservoir have access to lower reaches of Scotch, Camp and Fall Creeks below barriers where they may be competing with native trout for food and space, and cross-breeding with native fish with the consequence of an altered gene pool in surviving fish.

The genetic integrity of native trout is also an issue in upper Fall Creek which receives water, and trout, from Spring Creek in the Jenny Creek Watershed. This concern for genetic integrity transcends in reverse direction back to Spring Creek which may also have trout with altered genetic makeup due to intrusion of Fall Creek fish.

The limiting habitat factors for long-term sustainability of native fish and other aquatic species in the Klamath-Iron Gate Watershed include: unsurfaced roads and a lack of seasonal restrictions for them and logging in headwater streams, both of which contribute sediment and turbidity to streams; unmanaged livestock grazing in riparian habitat which retards recovery of riparian ecosystems; and diversion of water for domestic uses, irrigation, and production of hydroelectric power which reduces the amount of water in the streams.

INTRODUCTION

Objective of the Watershed Analysis

The Klamath-Iron Gate Watershed Analysis documents conditions and interrelationships of ecosystem components for the analysis area. It describes the dominant features and physical, biological, and social processes within the watershed. The document compares prehistorical (before 1850) and historical (reference) conditions with current ecosystem conditions and discusses the development of current conditions and future trends. It also ranks management objectives and recommendations for BLM-administered lands as high, medium, or low priority, and directs development of a landscape plan for BLM-administered lands. This document is intended to guide subsequent project planning and decision making in the Klamath-Iron Gate Watershed. This document is not a decision document under the National Environmental Policy Act (NEPA) and there is no action being implemented with this analysis. Site-specific analysis incorporating the NEPA process would occur prior to any project implementation on BLM-administered lands.

How The Analysis Was Conducted

The Klamath-Iron Gate Watershed Analysis was prepared by an interdisciplinary team of resource professionals and specialists from the Bureau of Land Management (BLM) Ashland Resource Area and Medford District Staff (see List of Preparers). The team also included a representative from the U.S. Fish and Wildlife Service. Some information for the California portion of the watershed was provided by the BLM Redding Field Office. Group discussions identified linkages among resources and resulted in an integrated, synthesized report.

Guidelines used to direct the preparation of the Klamath-Iron Gate Watershed Analysis include: the *Record of Decision for Amendments to Forest Service and Bureau of Land Management Planning Documents Within the Range of the Northern Spotted Owl, and Standards and Guidelines for Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USDA and USDI 1994a) (these two documents are combined into what is known as the Northwest Forest Plan), and *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis, Version 2.2* (USDA et al. 1995). Other documents referred to include the Medford and Redding Districts' Resource Management Plans. The Cascade/Siskiyou Ecological Emphasis Area (CSEEA) includes a large portion of the Klamath-Iron Gate Watershed. A management plan/environmental impact statement (EIS) is being developed for this area starting in September 1999. The record of decision for the EIS will dictate management actions in the portion of the Klamath-Iron Gate Watershed that lies within the CSEEA. This watershed analysis refers to the CSEEA Management Plan/EIS that is being prepared.

The Klamath-Iron Gate Watershed Analysis is based on existing information and addresses the entire analysis area, although recommendations are only made for BLM-administered lands. Where resource information is missing, a data gap is identified. Data gaps are prioritized and

listed in a separate section; missing information will be acquired as funding permits. The analysis process is dynamic and the document will be revised as new information is obtained. Types of new information may include resource data collected at the project level and monitoring data. An updated version of this document will be issued when new data and information collected indicate important changes in watershed conditions or trends.

Document Organization

The organization of this document follows the format described in the *Ecosystem Analysis at the Watershed Scale: Federal Guide for Watershed Analysis,* Version 2.2 (USDA et al. 1995). The Issues and Key Questions focus on the key ecosystem elements that are most relevant to the management questions and objectives, human values, or resource conditions within the analysis area. The Characterization section identifies the dominant physical, biological, and human processes or features of the watershed that affect ecosystem functions or conditions. The Current Conditions section details current conditions of the physical, biological, and human ecosystem elements. The Reference Conditions section describes how ecological conditions have changed over time as a result of human influences and natural disturbances in the Klamath-Iron Gate Watershed. The Synthesis and Interpretation section compares existing and reference conditions of specific ecosystem elements and explains significant differences, similarities, or trends and their causes. The Management Objectives and Recommendations section identifies management objectives for BLM-administered lands within the Klamath-Iron Gate Watershed and prioritizes management activities to achieve the objectives. The Landscape Planning section synthesizes resource data to create landscape objectives and recommendations for BLM-administered lands. Prioritized data gaps and monitoring and research needs are included in separate sections.

Maps are grouped together and placed at the end of the document. All maps for the watershed analysis were generated using BLM Medford District geographic information systems (GIS).

Public Involvement

Public participation for the Klamath-Iron Gate Watershed Analysis included two public meetings and the opportunity to submit written and/or verbal comments.

Letters were sent in January 1999 to the Klamath Tribe, the Quartz Valley Indian Reservation, the Cow Creek Band of Umpqua Indians, and the Confederated Tribes of Siletz and Grand Ronde, notifying them of the watershed analysis and requesting comments. A watershed characterization summary and the draft issues and key questions were sent to the tribes in April 1999. Verbal responses were received from the Klamath and Shasta Indian tribes. They both expressed an interest in archaeological and cultural resources and would like to be notified of any projects undertaken in the watershed. The Klamath Tribe also relayed a strong interest in fisheries and water issues.

Two open houses were held: the first was on April 20, 1999 at Bogus Elementary School, Montague, California from 5:30 p.m. to 7:30 p.m. and the second was on April 21,1999 at the U.S. Forest Service's Ashland Ranger District Office, Ashland, Oregon from 5:30 p.m. to

7:30 p.m. The Ashland open house was for both the Klamath-Iron Gate and Upper Bear Creek Watershed Analyses. Approximately 1,200 notices regarding the open houses were sent in April 1999 to residents within the analysis area, people who had previously submitted comments regarding the Cascade/Siskiyou Ecological Emphasis Area Plan, local agencies, and local groups including: Southern Oregon Timber Industry Association, Stockman's Association, Headwaters, Friends of the Greensprings, Motorcycle Riders Association, and Klamath Forest Alliance. The notice provided a map of the area, explained watershed analysis, and included a comment form for people to mail if they couldn't attend the open house. Flyers containing similar information were posted at public places near Hornbrook and Ashland and a news release was issued to newspapers across southwest Oregon and northern California, including Medford's *Mail Tribune* and Yreka's *Siskiyou Daily News*.

The two open houses were well attended and team members were available for questions from the public. The purpose of the open houses was to give the public the opportunity to share with the watershed analysis team their ideas, concerns, information regarding the historic or current conditions, and recommendations on how the watershed should be managed. Resource maps were displayed and several handouts were available. One handout explained the watershed analysis process and included a comment form, another handout summarized watershed characteristics identified by the team, and a third handout presented the draft issues and key questions.

Written comments received and verbal comments recorded at the open house meetings are summarized in Appendix A.

ISSUES AND KEY QUESTIONS

ISSUE: ***Human Uses***

Characterization

1. What are the land ownership patterns and land allocations in the watershed?
2. What are the major ways in which humans interact with the watershed?
3. Where are the primary locations for human use of the watershed?
4. What are the regional public concerns that are pertinent to the watershed (e.g., air quality, environmental degradation, commodity production, etc.)?
5. What are the public concerns specific or unique to this watershed?
   a. What are the access concerns?
6. Are there treaty or tribal rights in the watershed?
7. Are there tribal issues and concerns in the watershed?
8. What road types are in the watershed and where are they located?

Current Conditions

1. Who are the people most closely associated with and potentially concerned about the watershed?
2. What are the current human uses and trends of the watershed (economic, recreational, other)?
3. What is the current and potential role of the watershed in the local and regional economy?
4. What are the current conditions and trends of the relevant human uses in the watershed:
   a. government facilities, structures, and communication routes
   b. authorized and unauthorized uses
   c. land exchanges, sales, and transfers
   d. easements
   e. transportation system
   f. logging
   g. special forest products
   h. grazing/agriculture
   i. minerals
   j. recreation
   k. cultural resources

ISSUE: ***Human Uses (Continued)***

Reference Conditions

1. How did native people interact with the environment to create the native reference ecosystem?
2. What changes in human interactions have taken place since historic contact and how has this affected the native ecosystem?
3. What are the major historical human uses in the watershed, including tribal and other cultural uses?
4. What is the history of road development and use in the watershed?

Synthesis and Interpretation

1. What are the causes of change between historical and current human uses?
2. What are the influences and relationships between human uses and other ecosystem processes in the watershed?
3. What human effects have fundamentally altered the ecosystem?
4. What are the anticipated social or demographic changes that could affect ecosystem management?
5. What human interactions have been and are currently beneficial to the ecosystem and can these be incorporated into current and future land management practices?
6. How do roads affect wildlife?
7. What are the influences and relationships between roads and other ecosystem processes?
8. How do road stream crossings affect water quality, instream habitat, and fish migration?

ISSUE: ***Special Areas***

Characterization

1. What are the values of the Special Areas in the watershed?

Current Conditions

1. What are the current conditions of the Special Areas?

Reference Conditions

1. What was the historical condition of the Special Areas?

Synthesis and Interpretation

1. What are the natural and human causes of change between historical and current conditions?

ISSUE: ***Climate***

Characterization

1. What are the climatic patterns in the watershed?

ISSUE: ***Geology and Geomorphology***

Characterization

1. What is the origin of the broad variety of rock types in the watershed and where are they located?
2. How did the rock types influence landforms, soils, and vegetation?

ISSUE: ***Erosion Processes***

Characterization

1. What erosion processes are dominant within the watershed?
2. Where have they occurred or are they likely to occur?

Current Conditions

1. What are the current conditions and trends of the dominant erosion processes prevalent in the watershed?

Reference Conditions

1. What are the historical erosion processes within the watershed?
2. Where have they occurred?

Synthesis and Interpretation

1. What are the natural and human causes of changes between historical and current erosion processes in the watershed?
2. What are the influences and relationships between erosion processes and other ecosystem processes?

ISSUE: ***Soil Productivity***

Characterization

1. How critical/vulnerable is soil productivity in the watershed?

Current Conditions

1. What are the current conditions and trends of soil productivity?
2. What areas within the watershed are most vulnerable to soil productivity loss by management actions?

Reference Conditions

1. What were the historical soil productivity characteristics?

Synthesis and Interpretation

1. What are the natural and human causes of change between historical and current soil productivity conditions?
2. How do natural disturbances affect long-term soil productivity?
3. What are the influences and relationships between soil productivity and other ecosystem processes?

ISSUE: ***Landscape Vegetation Pattern***

Characterization

1. What is the array and landscape pattern of plant communities and seral stages in the watershed?
2. What is the percent composition of the vegetation condition classes over the landscape?
3. What processes caused these patterns?

Reference Conditions

1. What is the historical array and landscape pattern of plant communities and seral stages in the watershed?
2. What processes caused these patterns?

Synthesis and Interpretation

1. Have non-native species and noxious weeds changed the landscape pattern of native vegetation?

ISSUE: ***Plant Species and Habitats***

Characterization

1. Non-native Species and Noxious Weeds
   a. What is the relative abundance and distribution of non-native plants and noxious weeds?
   b. What is the distribution and character of their habitats?
2. Special Status Plant Species and Habitats
   a. What is the relative abundance and distribution of special status vascular plant species?
   b. What is the distribution and character of their habitats?
3. Survey and Manage Species and Habitats
   a. What is the relative abundance and distribution of survey and manage plant species?
   b. What is the distribution and character of their habitats?

Current Conditions

1. Non-native Species and Noxious Weeds
   c. What are the current habitat conditions and trends for non-native species and noxious weeds?
2. Special Status Plant Species and Habitats
   a. What are the current habitat conditions and trends for special status vascular species?
3. Survey and Manage Species and Habitats
   a. What are the current habitat conditions and trends for survey and manage species?

Reference Conditions

1. Non-native Species and Noxious Weeds
   a. What was the historical relative abundance and distribution of non-native species and noxious weeds and the condition and distribution of their habitats in the watershed?
2. Special Status Plant Species and Habitats
   a. What was the historical relative abundance and distribution of rare vascular species and the condition and distribution of their habitats in the watershed?
3. Survey and Manage Species and Habitats
   a. What was the historical relative abundance and distribution of survey and manage species and the condition and distribution of their habitats in the watershed?

ISSUE: ***Plant Species and Habitats (Continued)***

Synthesis and Interpretation

1. Non-native Species and Noxious Weeds
   a. What are the natural and human causes of change between historical and current species distribution and habitat quality for non-native species and noxious weeds in the watershed?
   b. What are the influences and relationships of non-native species and noxious weeds and their habitats with other ecosystem processes in the watershed?
2. Special Status Plant Species and Habitats
   a. What are the natural and human causes of change between historical and current species distribution and habitat quality for special status vascular species in the watershed?
   b. What are the influences and relationships of special status vascular species and their habitats with other ecosystem processes in the watershed?
3. Survey and Manage Species and Habitats
   a. What are the natural and human causes of change between historical and current species distribution and habitat quality for survey and manage species?

ISSUE: ***Forest Density and Vigor***

Current Conditions

1. What are the current conditions and trends of the prevalent plant communities and seral stages in the watershed?
2. What is the site index of the soils and how does it relate to present tree growth?
3. What vegetation condition classes are not meeting their growth potential?
4. What are the major mechanisms for vegetation disturbance?
5. Are there some vegetation condition classes promoting insect and disease problems?
6. Where are the tree insect and disease problem areas?

Reference Conditions

1. What was the historical tree vigor and growth pattern?
2. Were tree insects and disease a problem historically?

ISSUE: ***Forest Density and Vigor (Continued)***

Synthesis and Interpretation

1. What are the natural and human causes of change between historical and current vegetative conditions?
2. What are the influences and relationships between vegetation and seral patterns and other ecosystem processes in the watershed?
3. Which processes or causal mechanisms are most likely responsible for similarities, differences, and trends?
4. What are the implications of the changes and trends, including the capability of the watershed to achieve objectives from existing plans?
5. What are the reasons for differences between current and reference tree growth patterns?

ISSUE: ***Fire and Air Quality***

Characterization

1. What are the fire regimes?
2. How is air quality effected by prescribed fire and wildfire?

Current Conditions

1. What role does fire currently have?
2. What vegetation conditions are contributing to high fire hazard and risk?
3. What are the current fire hazards and risks?
4. What are the high values at risk that could be impacted by a wildfire?
   a. What are the risks to public health and safety?
5. What is the current condition of air quality resulting from prescribed fire and wildfires?

Reference Conditions

1. What was the historic role of fire within the watershed?

Synthesis and Interpretation

1. How have fire suppression efforts over the past 80 years caused changes between the historical and current role of fire?
2. How has the fire role change caused changes between historical and current vegetative species distribution?

ISSUE: ***Terrestrial Wildlife Species and Habitats***

Characterization

1. Wildlife Habitat - General
   a. What is the relative abundance, distribution and character of the various habitat types found in the watershed?
2. Threatened and Endangered Species
   a. What is the acreage, distribution and character of habitat in the watershed?
   b. What is the role of the designated critical habitat in the watershed?
3. Special Status/Sensitive Species
   a. What is the amount, distribution and character of habitat for those special status species that are of management concern in the watershed?
4. Survey and Manage Species
   a. What is the amount, distribution and character of habitat for the survey and manage species found in the watershed?
5. Deer and Elk
   a. What is the amount, distribution and character of forage and cover on the deer and elk management areas in the watershed?

Current Conditions

1. Wildlife Habitat - General
   a. What are the current habitat conditions and trends for the various habitat types found in the watershed?
2. Threatened and Endangered Species
   a. What are the current habitat conditions and trends for the threatened and endangered species found in the watershed?
   b. What is the current role of habitat in the watershed?
3. Special Status/Sensitive Species
   a. What are the current habitat conditions and trends for the special status/sensitive species found in the watershed?
4. Survey and Manage Species
   a. What are the current habitat conditions and trends for the survey and manage species found in the watershed?
5. Deer and Elk
   a. What are the current forage and cover conditions and trends on the deer and elk management areas in the watershed?

ISSUE: ***Terrestrial Wildlife Species and Habitats (Continued)***

Reference Conditions

1. Wildlife Habitat - General
   a. What was the historical relative abundance, condition and distribution of the various habitat types found in the watershed?
2. Threatened and Endangered Species
   a. What was the historical acreage, condition and distribution of habitat for threatened and endangered species in the watershed?
   b. What was the initial role of habitat for threatened and endangered species in the watershed?
3. Special Status/Sensitive Species
   a. What was the historical amount, condition and distribution of habitat for the special status/sensitive species found in the watershed?
4. Survey and Manage Species
   a. What was the historical amount, condition and distribution of habitat for the survey and manage species found in the watershed?
5. Deer and Elk
   a. What was the historical amount, condition and distribution of forage and cover on the deer and elk management areas in the watershed?

Synthesis and Interpretation

1. Wildlife Habitat - General
   a. What are the implications of natural and human caused change between historical and current relative abundance, condition and distribution of the various habitat types found in the watershed?
2. Threatened and Endangered Species
   a. What are the implications of natural and human caused change between historical and current acreage, condition and distribution of northern spotted owl habitat in the watershed?
   b. What are the implications of the change in role of the northern spotted owl critical habitat in the watershed?
3. Special Status/Sensitive Species
   a. What are the implications of natural and human caused change between historical and current amounts, condition and distribution of habitat for the special status/sensitive species found in the watershed?
4. Survey and Manage Species
   a. What are the implications of natural and human caused change between historical and current amounts, condition and distribution of habitat for the survey and manage species found in the watershed?
5. Deer and Elk
   a. What are the implications of natural and human caused change between historical and current amounts, condition and distribution of forage and cover on the deer and elk management areas in the watershed?

ISSUE: ***Hydrology***

Characterization

1. What are the dominant hydrologic characteristics and other notable hydrologic features and processes in the watershed?

Current Conditions

1. What are the current conditions and trends of the dominant hydrologic characteristics and features prevalent in the watershed?

Reference Conditions

1. What were the historical hydrologic characteristics and features in the watershed?

Synthesis and Interpretation

1. What are the natural and human causes of change between historical and current hydrologic conditions?
2. What are the influences and relationships between hydrologic processes and other ecosystem processes?

ISSUE: Stream Channel

Characterization

1. What are the basic morphological characteristics of stream valleys or segments and the general sediment transport and deposition processes in the watershed?

Current Conditions

1. What are the current conditions and trends of stream channel types and sediment transport and deposition processes prevalent in the watershed?

Reference Conditions

1. What were the historical morphological characteristics of stream valleys and general sediment transport and deposition processes in the watershed?

Synthesis and Interpretation

1. What are the natural and human causes of change between historical and current channel conditions?
2. What are the influences and relationships between channel conditions and other ecosystem processes in the watershed?

ISSUE: ***Water Quality***

Characterization

1. What beneficial uses dependent on aquatic resources occur in the watershed?
2. Which water quality parameters are critical to these uses?

Current Conditions

1. What are the current conditions and trends of beneficial uses and associated water quality parameters?

Reference Conditions

1. What were the historical water quality characteristics of the watershed?

Synthesis and Interpretation

1. What are the natural and human causes of change between historical and current water quality conditions?
2. What are the influences and relationships between water quality and other ecosystem processes in the watershed?

ISSUE: ***Riparian Areas***

Characterization

1. What is the array and landscape pattern of plant communities in the riparian areas?
2. What processes caused these patterns?
3. What riparian-dependent species are present in the watershed?
4. What are the general distribution and character of their habitats?

Current Conditions

1. What is the current species composition of riparian areas?
2. What are the current conditions and trends of riparian areas?
3. Where are sensitive areas and what are the reasons for sensitivity?
4. What are the current conditions and trends of riparian habitat for riparian-dependent species?

Reference Conditions

1. What was the historical condition of riparian areas?
2. What was the historical species composition of riparian areas?
3. What was the historical distribution and abundance of riparian-dependent wildlife species (community)?

ISSUE: ***Riparian Areas (Continued)***

Synthesis and Interpretation

1. What are the natural watershed characteristics and human activities influencing riparian areas and riparian-dependent species?
2. How have these characteristics and activities influenced or changed riparian areas and habitat for riparian-dependent species?
3. What is the effect of riparian condition on instream habitat?
4. What are the influences and relationships between riparian areas and other ecosystem processes in the watershed?

ISSUE: ***Aquatic Wildlife Species and Habitats***

Characterization

1. Habitat
   a. What is the distribution and character of aquatic habitat throughout the watershed, especially for threatened and endangered, special status, and sensitive species?
2. Species
   a. What are the relative abundance and distribution of aquatic wildlife species of concern (e.g., threatened and endangered, and special status/sensitive)?
   b. What are the relative abundance and distribution of other aquatic wildlife species present in the watershed?

Current Conditions

1. Habitat
   a. What are the current condition and trends of instream habitat (e.g., quantity and quality) throughout the watershed?

Reference Conditions

1. Habitat
   a. What was the historical condition and distribution of instream habitat throughout the watershed?
2. Species
   a. What was the historical relative abundance and distribution of aquatic wildlife species of concern and other aquatic wildlife species?

ISSUE: ***Aquatic Wildlife Species and Habitats (Continued)***

Synthesis and Interpretation

1. Habitat
   a. What are the natural watershed characteristics and human activities influencing species distribution and instream habitat condition?
   b. How have these characteristics and activities influenced or changed instream habitat condition, in general and specifically for threatened and endangered and special status/sensitive species?
2. Species
   a. How have changes in habitat condition influenced threatened and endangered and special status/sensitive aquatic species in the watershed?
   b. What are the limiting factors for long-term sustainability of threatened and endangered and special status/sensitive aquatic species?
3. Ecosystem Processes
   a. What are the influences and relationships of aquatic species and their habitats with other ecosystem processes in the watershed?

WATERSHED CHARACTERIZATION

The purpose of the Characterization section is to identify the dominant physical, biological, and human processes or features of the watershed that affect ecosystem functions or conditions. The watershed analysis team identified the relevant land use allocations and the most important plan objectives and regulatory constraints that influence resource management in this watershed.

INTRODUCTION

The Klamath-Iron Gate Watershed is located at the intersection of the Klamath Mountains and the southern Cascade range. The watershed is approximately 15 miles southeast of Ashland, Oregon and approximately 20 miles northeast of Yreka, California (Map 1). The watershed covers lands in both Oregon and California. It is primarily within Jackson County, Oregon and Siskiyou County, California, but also contains a small piece of Klamath County, Oregon. The watershed extends from the ridge between Soda Mountain and Pilot Rock in the north to the Iron Gate Reservoir in the south. It includes Scotch Creek to the west and Fall Creek to the east, but does not include the Jenny Creek Watershed. The Klamath-Iron Gate Watershed is within the Upper Klamath River Subbasin of the Klamath River Basin. Major tributaries within the Klamath-Iron Gate Watershed include Scotch, Camp and Fall Creeks (tributaries to the Iron Gate Reservoir). The Klamath-Iron Gate Watershed covers approximately 66 square miles (42,360 acres) and the elevation ranges from approximately 2,330 feet at Iron Gate Dam to 6,091 feet at the top of Soda Mountain.

Land Ownership

Land ownership is a mix of private and public (Table 1 and Map 2). There are private lands at lower elevations along the Klamath River and several of its tributaries, and at higher elevations along Fall Creek. The Bureau of Land Management (BLM), Ashland Resource Area manages a large block of land south of Soda Mountain in Oregon and scattered sections along Fall Creek in Oregon. The BLM, Redding Field Office manages a checkerboard of sections in the southwest portion of the watershed south of the state line and some isolated parcels in the southeast portion of the watershed in California. The BLM, Klamath Falls Resource Area manages approximately 71 acres on the eastern edge of Fall Creek. The State of California manages checkerboard sections adjacent to BLM-managed lands in the southwest portion of the watershed.

Table 1. Land Ownership

Ownership	Acres	Percent of Watershed
BLM, Medford District, Ashland Resource Area	13,698	32.3
BLM, Ukiah District, Redding Field Office	4,306	10.2
BLM, Lakeview District, Klamath Falls Resource Area	71	0.2
Total BLM	18,075	42.7
State of California	4,063	9.6
Private	20,222	47.7
Total	42,360	100.0

Federal Land Use Allocations

Federal land use allocations in the watershed are shown in Table 2 and Map 3. Objectives and management actions/directions for these land use allocations are found in the Medford District and Redding Resource Management Plans (USDI 1995a and USDI 1993).

Table 2. Federal Land Use Allocations

Federal Land Allocations	Acres[1]
Matrix	17,733
Riparian Reserves (estimated)[2]	6,001
District Defined Reserves	342
Special Areas	
Pilot Rock Area of Environmental Concern	25
Scotch Creek Research Natural Area[3]	1,723
Bean Cabin Recreation Site[3]	4
Pokegama Wild Horse Management Area	7,629
Horseshoe Ranch Wildlife Area[3,4]	6,325
Cascade/Siskiyou Ecological Emphasis Area[3,5]	4,514
Special Recreation Management Area	
Pacific Crest National Scenic Trail[3]	93
Wilderness Study Area	
Soda Mountain[3,5]	5,785

1/ Acres within the Klamath-Iron Gate Watershed
2/ Riparian Reserves occur across all land allocations
3/ Overlaps Matrix land allocation
4/ Horseshoe Ranch Wildlife Area is managed by California Department of Fish and Game; acres include State-managed lands
5/ Overlaps District Defined Reserves allocation

Special Areas

The Bean Cabin Recreation Site is addressed under Recreation in the Current Condition section, Horseshoe Ranch Wildlife Area is discussed in this section under Terrestrial Wildlife Species and Habitats and the Pokegama Wild Horse Management Area is discussed in the Current Condition section under Grazing.

The Pilot Rock Area of Environmental Concern (ACEC) was established to protect and prevent irreparable damage to important historic, scenic, wildlife, geological, and botanical values. The ACEC is 544 acres of which only a small portion (38 acres) lies within the watershed boundary. No timber harvest or off-highway vehicle (OHV) use is allowed in the ACEC, also, mineral leasing is subject to the no surface occupancy special stipulations.

The Scotch Creek Research Natural Area (RNA) was established for the scientific study of a chaparral community and to provide baseline data for ecological research in a relatively undisturbed ecosystem. This area is 1,799 acres (totally within the Klamath-Iron Gate Watershed) and is closed to mineral entry and OHV use. Because the overriding guideline for management of an RNA is that natural processes are allowed to dominate, deliberate manipulation is allowed only on a case specific basis when the actions either simulate natural processes or important information for future management of the RNA is gained. The appropriateness of various existing and foreseeable potential uses and impacts (including grazing, development, fire, timber harvest, rights-of-way, public activities and other forms of use) shall be addressed and specific conflict resolutions developed by a management plan. Presently, no management plan has been developed for this RNA.

The Cascade/Siskiyou Ecological Emphasis Area (CSEEA) management plan, currently under development, will provide coordinated management of this biologically diverse area that includes the Soda Mountain Wilderness Study Area (WSA), two RNAs, two ACECs, the Jenny Creek LSR, and the Pacific Crest Trail. The area has unique ecological values due to its location near the boundaries of the Cascade, Siskiyou, and Coast Range mountains and the Great Basin Desert. The total CSEEA area is 43,820 acres; 5,314 acres are within the Klamath-Iron Gate Watershed, of which 4,514 acres are managed by the BLM. Timber harvest is deferred pending completion of the CSEEA management plan.

HUMAN USES

Major human uses of the land today include ranching and grazing, timber harvest, and recreation. The Pacific Crest National Scenic Trail runs across the northwestern watershed boundary and there are campgrounds and day-use areas associated with Iron Gate Reservoir.

Regional public issues reflect the dominant uses of the watershed and include concerns with recreational activities (off-highway vehicle use, OHV); grazing and timber harvest on public lands; concerns over general degradation of the natural environment; concerns about fish and water quality; and concerns regarding Siskiyou/Cascade ecological linkages.

Public concerns more specific to this watershed include: lack of communication with the Redding BLM; land acquisition for Horseshoe Ranch and management of the Ranch for deer winter range; Schoheim road; bioregion connectivity; the spread of noxious weeds water transfer from Jenny Creek to Fall Creek for hydroelectric power; the municipal water supply from Fall Creek for Yreka; the Soda Mt. land exchange; access concerns (both by those wanting limited access and those wanting unlimited access); closing roads to prevent wildlife harassment (Oregon Department of Fish and Wildlife) and keeping roads open to provide access for fire suppression (Oregon Department of Forestry); and concerns over private property rights.

Cultural Resources

There are numerous archaeological sites representing the history of both the native and immigrant peoples of this area. Sites representing thousands of years of human occupation before the advent of Euro-Americans occur along the Klamath River, its tributaries, and along ridges and in mountain meadows. These sites represent both permanent habitation and seasonal use of the area. Traditional cultural properties, represented by traditional gathering areas and sacred sites, are known for some of the descendants of the native people (Shasta) in the California portion of the watershed.

Historic Euro-American settlement, ranching, agriculture, logging, and the development of hydroelectric power are also represented by the historic archaeology of the region. Historic sites may occur throughout the watershed, though are more likely to be found along the creeks and streams.

Both native and historic Euro-Americans actively managed the land. Native peoples burned the land for various purposes, and used other techniques to enhance the resources they needed. Historic grazing, hunting, fire, logging, and hydroelectric development affected various aspects of the environment. The current conditions of the land today reflect many centuries of human activity within it.

Native American Tribes

Both the Klamath and the Shasta Indian tribes claim an interest in the watershed lands. The Klamath Tribe is a federally recognized tribe with offices in Chiloquin, Oregon. The Shasta have federal recognition through the Quartz Valley Rancheria, located in Fort Jones, California, and are also organized in various separate groups (the Shasta Nation; the Confederated Bands of Shasta Upper Klamath Indians). The Klamath have expressed a strong interest in the watershed, especially regarding the Klamath River and fisheries and water issues, as well as cultural heritage concerns. The Shasta have cultural heritage concerns and an interest in traditional plants and sacred areas within the watershed. Both groups wish to be consulted concerning future projects in the watershed. There are no treaty reserved rights within the Klamath-Iron Gate Watershed.

Transportation System

Roads in the watershed are owned or managed by the BLM, timber companies, Jackson County, and many private landowners. Major roads crossing the watershed are the Schoheim road (BLM road 41-2E-10.1) from east to west and the privately owned Copco road (40-3E-3.1) from north to south. These and other roads are shown on Map 4.

Travel routes in the watershed are used by cars, trucks, heavy equipment, motorcycles, bicycles, horses, pedestrians, and other modes of transportation. These routes are used for recreation, resource management, and private property access. The BLM provides a transportation system for many different recreation experiences and management opportunities.

Three road surface types are found on BLM roads: bituminous (asphalt), rocked, and natural (no surface protection). Main access roads usually have a bituminous surface, but may have a crushed rock surface. Roads off main access roads usually have a crushed rock surface, and dead end spurs generally have a natural surface. Adequately surfaced roads generally allow for year-round travel and reduce soil erosion, which helps to minimize stream sedimentation. There are developed quarries on private and federal land in the watershed where rock may be obtained for surfacing roads and drainage protection. The BLM obtains water from developed water sources in the watershed for road operations.

Road planning, location, design, construction, use, and maintenance are conducted with the goal of meeting transportation objectives while protecting resources. Best Management Practices from the Medford District Resource Management Plan (USDI 1995a, pages 149-177) provide guidance.

CLIMATE

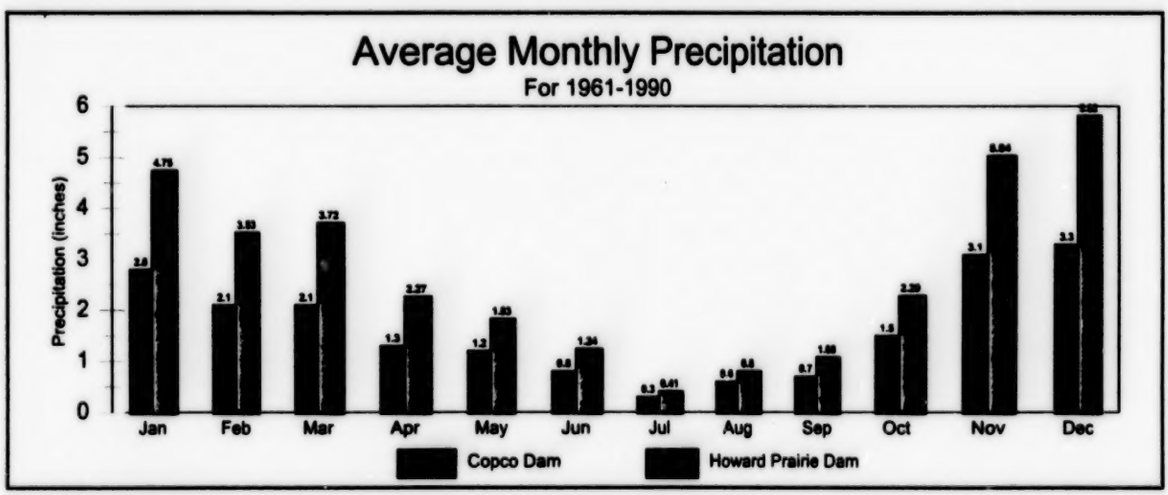
The Klamath-Iron Gate Watershed is characterized by mild, wet winters and hot, dry summers. During the winter months, the moist, westerly flow of air from the Pacific Ocean results in frequent storms of varied intensities. Average annual precipitation in the Klamath-Iron Gate Watershed ranges from approximately 20 inches near the Iron Gate Dam (elevation 2,330 ft.) to 38 inches at Soda Mountain (elevation 6,091 ft.) and 34 inches at Grizzly Mountain (elevation 5,112 ft.) (Map 5). Winter precipitation in the higher elevations usually occurs as snow, which ordinarily melts during the spring runoff season from April through June. Rain predominates in the lower elevations with the majority occurring in the late fall, winter, and early spring. A mixture of snow and rain occurs between approximately 3,500 feet and 5,000 feet and this area is referred to as either the rain-on-snow zone or transient snow zone. The snow level in this zone fluctuates throughout the winter in response to alternating warm and cold fronts. Rain-on-snow events, such as the one that occurred on January 1, 1997, originate in the transient snow zone. Table 3 shows the percent of each precipitation zone by subwatershed and the zones are displayed on Map 6.

Table 3. Precipitation Zone Distribution

Subwatershed	Rainfall Zone (<3,500 ft.) (percent)	Rain-on-Snow Zone (3,500 - 5,000 ft.) (percent)	Snow Zone (>5,000 ft.) (percent)
Scotch Creek	47.8	50.9	1.3
Camp Creek	46.4	40.4	13.2
Fall Creek	38.6	61.3	0.1
Iron Gate	99.7	0.3	0
Totals for Watershed	55.5	40.2	4.3

The National Oceanic and Atmospheric Administration (NOAA) weather station at Copco Dam (elevation 2,700 ft.), located on the Klamath River approximately two miles upstream of Fall Creek, provides precipitation data that is representative of the lower portions of the watershed. The NOAA weather station at Howard Prairie Dam (elevation 4,568 ft.) located in the Jenny Creek Watershed approximately 11 miles northeast of Soda Mountain, provides precipitation data that is reflective of higher elevations in the Klamath-Iron Gate Watershed. Precipitation distributions by monthly average for the Copco Dam and Howard Prairie Dam stations are shown in Figure 1. The majority of precipitation falls during November through March (68 to 70 percent of the yearly total). Annual precipitation fluctuates from year-to-year. The 30-year average (normal) annual precipitation is 19.8 inches at the Copco Dam station (World Climate Internet Site 1999) and 32.8 inches at the Howard Prairie Dam station (NOAA 1996).

Figure 1. Precipitation at Copco Dam and Howard Prairie Dam NOAA Stations



During the summer months, the area is dominated by the Pacific high pressure system, which results in hot, dry summers. Summer rainstorms occur occasionally and are usually of short duration and limited area coverage. The nearest NOAA weather stations with air temperature data are located at Howard Prairie Dam and the City of Yreka, California (elevation 2,624 ft.; approximately 17 miles southwest of Iron Gate Dam). Average monthly maximum, mean, and

minimum air temperatures for these two stations are displayed in Figures 2 and 3.

Figure 2. Air Temperature at Howard Prairie Dam NOAA Station

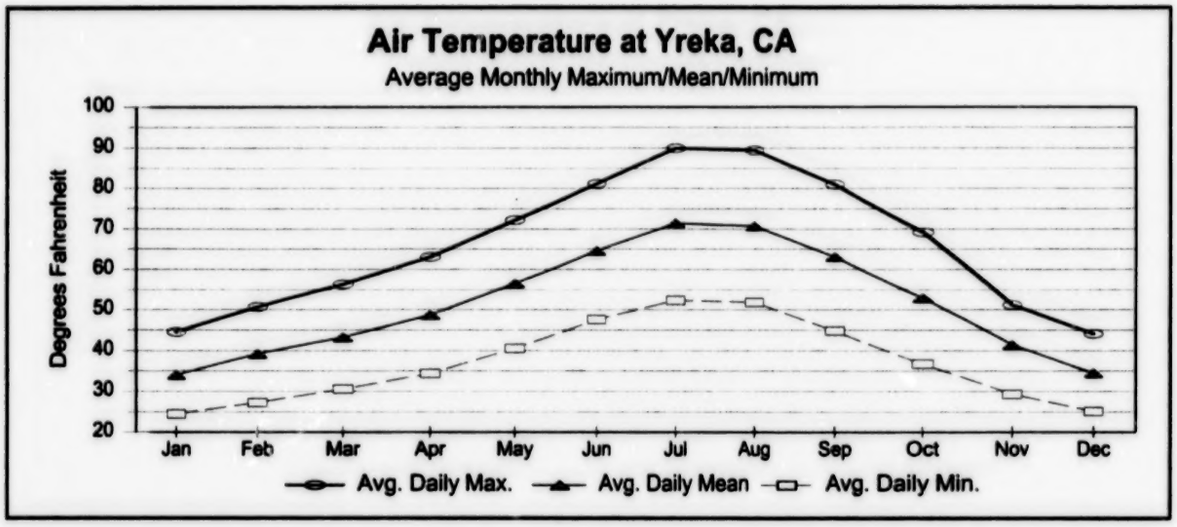
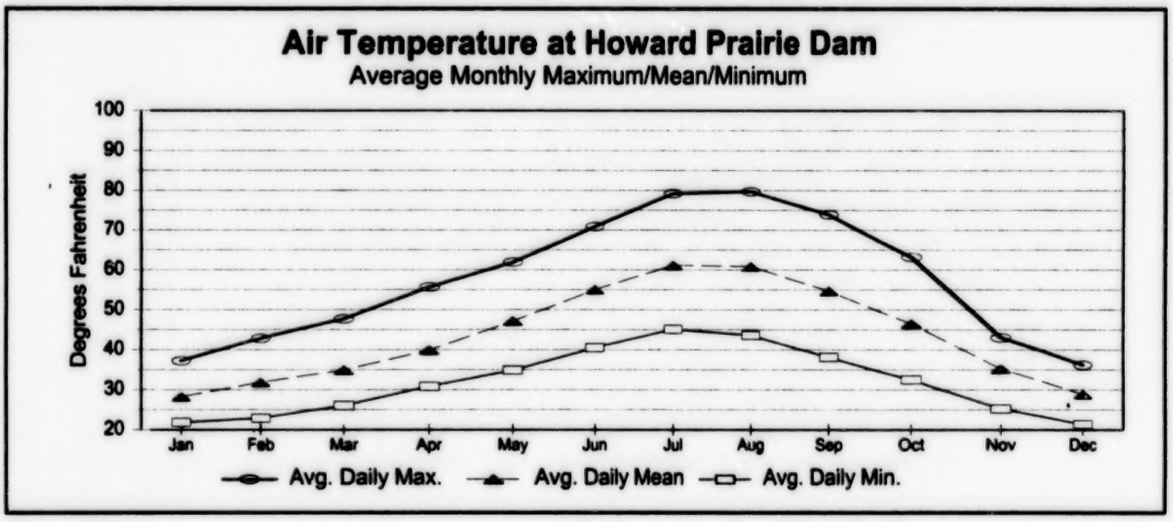


Figure 3. Air Temperature at Yreka NOAA Station



Current climatic patterns need to be viewed with a long-term perspective. Based on tree-ring growth rates and recorded meteorological data, the past 200 to 300 years have been marked by cycles of hot, dry spells and temperate-to-cool weather that have lasted varying periods of time (LaLande 1995).

GEOLOGY AND GEOMORPHOLOGY

The Klamath-Iron Gate Watershed is located in the Cascade Mountain Geologic Province. The Cascade Mountains are divided into two belts, or subprovinces, that trend north and south. The older, deformed rock on the west is referred to as the Western Cascade Subprovince, and the undistorted rock on the top and east flank is the High Cascades Subprovince. The Klamath-Iron Gate Watershed lies mainly within the Western Cascade Subprovince.

Western Cascades Subprovince

The Western Cascades rest on top of, or adjacent to, the Klamath Mountains. The Western Cascades developed mainly from shield volcanos. A majority of the Western Cascades are dominated in this watershed by lava flows of basaltic andesite, basalt, and andesite. These lavas are interlayered with softer pyroclastic flows of andesitic tuff, basaltic breccia, ash flow tuff, dacite tuff, and andesitic breccia. These pyroclastic materials often interfinger with the lavas making the area subject to landsliding or soil movement during rain-on-snow or intense storm events.

Volcanic activities/eruptions of the Western Cascades were constructional features during the early formation of the Cascade Mountains. Geologic mapping and potassium-argon ages suggest that Cascade Range volcanism was widespread approximately 35 million years ago (Sherrod and Smith 1989). Fluid basaltic lavas from small, broad shield volcanos built the ancient topography into a more gentle and flatter mountain range.

During late Oligocene (35 million years ago) and early Miocene (25 million years) time, basaltic and andesitic volcanos of moderate height grew and lavas were erupted onto mountainous terrain and filled valleys (Kienle et al. 1981). Dacitic pyroclastic flows from distant sources were erupted and intermittently deposited in some of the lowland areas between and over portions of the basalt and andesite lava flows from larger stratovolcanos to the north. These softer rock types were eventually covered, at least partially, by newer lava flows and pyroclastic eruptions.

Following their formation, the Western Cascades were severely eroded and virtually buried beneath the younger High Cascade as a result of shield volcanoes that erupted seven to three million years ago. Soda Mountain is an example of a High Cascade shield volcano. These volcanoes form gently sloping land beginning at about 3,500 feet and rise to near 5,000 feet above sea level. Tectonic plate movement began to uplift the Cascade Province. As the Western Cascades were uplifted, erosion tended to remove the "soft" Western Cascade slopes at a faster rate than the "hard" valley-filling lava flows. This differential erosion over millions of years has resulted in an inversion of topography, with massive rock outcrops (old valley floors) now capping ridge tops. Lone Pine Ridge is an example of this phenomenon.

The Ice Age began about two million years ago and was a time of glaciation on the landscape. Glacial erosion produced cirques, U-shaped valleys and glacial moraines. The Ice Age climate included cold periods during which glaciers formed and advanced downslope, and warm dry periods similar to today's climate. The wet periods were conducive to development of

landslides and earthflows. The retreat of the glaciers also left many over-steepened headwalls and side slopes that were not capable of maintaining stability. Hill slopes, often unstable where steep terrain and/or pyroclastic rock types were found underlying lava flows, were deposited on the glaciated valley floor. Most of the largest landslide deposits are generally located in the eastern half of the watershed in the Fall Creek drainage.

Faulting and Earthquakes

There are a few ancient faults located within the watershed. Two small faults are located below Soda Mountain and trend northeasterly perpendicular to Camp Creek. These faults span across Lone Pine Ridge and typically have only about 10 feet of displacement (Kienle et al. 1981). Another long fault occurs near the north end of the Fall Creek drainage which trends northerly and ends east of Little Chinquapin mountain near Fredenburg springs (Naslund 1977).

Earthquakes have occurred in the watershed over time, but most of the recent earthquakes had an epicenter near Klamath Falls. The region is affected by Klamath Falls basin and range extensional faulting, which has resulted in numerous fault block movements over long periods of geologic time. Large earthquakes from Klamath Falls have occurred as recently as 1993. On October 27, 1993 an earthquake that measured at 6.1 on the Richter scale shook a large portion of southern Oregon. Buildings, roads, and bridges do not usually sustain damage from earthquakes of this size and at this distance from the epicenter.

Soil Development

By 10,000 years ago, the glaciers had disappeared, and the warm dry climate of the Holocene Epoch began. The interactions, through time, of climate, living organisms, parent materials, and topographical relief resulted in the development of soil. Most of the soil that originally formed alluviated to valley bottoms. As the valley floor began to fill with soil it created a base for soil to accumulate on the mountain toe slopes and side slope depressions. Wet climatic periods would cause the soil to move down the landscape resulting in discontinuity of depth.

The soils and topography that formed in this watershed were directly influenced by the weatherability of the parent material. The strata of hard andesite and basalt include soft breccia and tuffaceous rock. The soils in areas that receive a greater amount of precipitation tend to be deeper and more developed due to the interacting influences of the basic mineralogy of the volcanic parent material and the accumulation of organic matter.

Soils that formed in material weathered from hard andesite and basalt are shallow and medium textured. Other soils in this watershed that not only formed from hard bedrock but also were influenced by soft, easily weathered tuff and breccia are fine textured and often have zones of clay accumulation.

Refer to the General Soil Types map (Map 7) for location of the soils on the landscape.

EROSION PROCESSES

There are three main erosion processes in the Klamath-Iron Gate Watershed: surface erosion, channel cutting, and mass wasting. Surface erosion and channel cutting are responsible for the majority of annual sediment transport to streams in the watershed.

Surface Erosion

Surface erosion is the detachment and transport of individual soil particles or small aggregates from the land surface (Satterlund and Adams 1992). It is caused by the action of rain-drops and surface runoff. It may remove soil in more or less thin layers (sheet erosion), in rills, or in gullies. Rills and gullies occur most often when surface water runoff is concentrated and confined into narrow spaces, especially on coarse-grained soils. On steep, dry slopes, gravity alone may be sufficient to cause movement (ravel) (Satterlund and Adams 1992). Surface erosion generally occurs in areas where bare soil is exposed by roads, fire, timber harvesting, grazing, or land development. The largest volumes of sediment are moved during intense, long-duration storms.

Channel Cutting

Channel cutting is the detachment and movement of material from a stream channel. It may result from the movement of individual particles, as in shifting grains of sand in bars, or from mass movement, as when a large part of an undercut bank falls and is swept downstream (Satterlund and Adams 1992).

Mass Wasting

Mass wasting is a term for describing a wide variety of processes that involve natural or human-caused downslope movement of masses of soil and rock material. The term "landslide" is commonly used as a blanket term that covers several modes of slope instability (Haneberg and Sims 1995). When these processes are active, as they were during the January 1997 storm, large adjustments in stream channels and hillslopes can occur (Haneburg and Sims 1995). Landslides can transport material rapidly as in the case of debris torrents, or occur slowly as with earthflows or creep movement. These mass wasting events often cause adverse impacts to fisheries habitat by depositing large volumes of sediment into the streams. Roads, bridges, and culverts are often damaged when major flood events, such as the 1964, 1974, and 1997 floods, trigger landslides.

Large portions of the Western Cascades and the western edge of the High Cascades Subprovince in the Klamath-Iron Gate Watershed are moderately stable to unstable due to steep slopes, moderate precipitation rates, and the natural weakness of many of the volcanic soil/rock types.

Slump earthflows: Slumps are small localized failures that move as a unit and travel short distances from where they originate. Slumps are often associated with road cut and fill slopes or small localized areas of instability. Slumps generally do not deliver significant volumes of

sediment to streams unless they are located adjacent to stream channels. Slumps are the most common type of slide and occur throughout the watershed.

Debris slides: Debris slides are one of the primary mechanisms for the delivery of coarse sediment to streams. These are rapid mass wasting events that carry large volumes of rock, soil, and vegetation downslope. Debris slides are often associated with steep slopes, unstable stream channels, and other wetland areas. Debris slides are the second most common type of landslide in the watershed.

Debris flows/torrents: These slides transport large volumes of material and move further downslope producing more sediment than all other landslides. Large rocks and coarse woody material (CWM) are also transported to area streams with this type of landslide. Debris torrents are the third most common type of landslide in this watershed.

Earthflows: Earthflows are slow moving landslides that generally travel shorter distances downslope than debris flows/slides. Unless they occur adjacent to streams, earthflows enter streams less often and with less material than debris slides and flows. These slides can be very large and deep. Earthflows may also occur in combination with other failure types. Earthflows are the least common type of landslide in the watershed.

SOIL PRODUCTIVITY

Soil of the Klamath-Iron Gate Watershed serves two important functions: it is the primary medium for most vegetative life in the watershed, and it filters and stores water that is slowly released into the nearby streams.

Soil productivity is the capability of a soil to produce a specified plant or sequence of plants under specific management (USDA 1993). Soil productivity of forest lands is largely defined in terms of site quality, which is measured by the volume of timber the land can produce in a given time. Site quality within a given microclimate is associated with the soil's capacity to provide moisture and nutrients. The soil's ability to provide moisture is dependent on the texture, depth, and rock fragment content in the rooting zone. The soil's ability to provide nutrients necessary for plant growth is dependent on soil organisms and organic matter content. Beneficial soil organisms control many biological processes within the soil, such as organic matter decomposition, nitrogen fixation, and plant nutrient uptake (Amaranthus et al. 1989). A cool, moist environment with an abundance of suitable organic matter encourages the growth and productivity of these organisms. Surface duff and woody material insulate the soil layer and keep soil conditions cool and moist. Therefore, the depth of surface duff and the abundance of downed woody material is a good indication of site productivity.

Generally, the more productive forest soils are found in areas of higher precipitation, on northerly aspects, adjacent to streams, or in areas of dense forest canopy. The soils in the Klamath-Iron Gate Watershed are relatively young in geologic terms and are still forming. As a result, they are highly vulnerable to disturbance agents such as fire and floods that offset the soil forming factors. This is particularly the case on the southern and western aspects where

soils are shallow and/or rocky.

LANDSCAPE VEGETATION PATTERN

Landscape Patterns

The present day vegetation pattern across the watershed landscape results from the dynamic processes of nature and human influences over time. As a consequence, the variation and scales of landscape components are innumerable.

Landscape ecological analysis and design are not new concepts, but have been brought to the forefront of natural resource management with the concept of ecosystem-based management. Landscapes are thought of as aggregates of similar patches of vegetation and landforms that originate through climatic influences, geomorphic processes, natural disturbances, human activities, and plant succession (Forman and Godron 1986). Diaz and Apostol (1992) describe landscapes as having three elements: matrix, patches, and corridors. Matrix is defined as the most contiguous vegetation type; patches are areas of vegetation that are similar internally, but differ from the vegetation surrounding them; and corridors are landscape elements that connect similar patches through a dissimilar matrix or aggregation of patches. Ecological analysis of the landscape considers the processes that form the landscape patterns, the arrangement and extent of various vegetative types, and the three-dimensional shape of the land, along with causes and rates of change.

A vegetation map derived from Landsat imagery for the Klamath Bioregional Assessment Project (Fox 1997) was used to describe the landscape vegetation pattern (Map 8). The imagery was acquired by satellite between June 4, 1994 and August 9, 1994 with a pixel size of 30 meters by 30 meters (.09 hectares; .22 acres). Structural vegetation patterns and landforms were classified to indicate habitat types and canopy closure stages similar to the California Wildlife Habitat Relationships (WHR) classification system.

In southern Oregon, on the southern slopes of the Klamath Mountains, the landscape matrix is mid to mature seral stage forest. Within this forest matrix are large patches of shrublands and woodlands and some grasslands. In draws with favorable aspects the forest stands can be considered as corridors. This only applies to the northern portion of the watershed.

South of this area of forest matrix the matrix area shifts to shrublands and woodlands. Within this shrubland/woodland matrix are large patches of grassland and small patches of pole sized trees.

A different vegetation pattern is evident when the vegetation structure (various seral stages of the endemic vegetation types and the inherent height differences) is analyzed. The vegetation pattern becomes more complex as more structural components are included in the analysis. A patchy vegetation pattern is the result of different vegetation diameter and height classes, topoedaphic influences, and disturbances. The satellite imagery map categorizes the watershed vegetation into various vegetation types, landform types, and seral stages. The percent

composition of each plant classification in the watershed is shown in Table 4.

Table 4. Structural Classification of Klamath-Iron Gate Watershed Vegetation

Water	2				
Grass	13				
Shrubland	39				
Hardwoods	27	Defined as all hardwoods regardless of size or canopy closure.			
Early Seral Vegetation	4	Originally defined as recent clearcut but may also include grassland.			
Poles	1	<10"	conifer & mixed	all stories	all closures
Large Poles	6	10-19"	conifer & mixed	all stories	all closures
Mature	8	>20"	conifer & mixed	all stories	<65
		>20"	conifer & mixed	1 story	≥ 65

Source: Fox 1997; Landsat (one pixel = 30 meters)

Seral Stages

Natural succession will continuously change the landscape vegetation and there is no single stage of a forest that can be considered to be the only natural stage. The mature seral stage (approximately 80 to 200 years of age) is the stage when vegetation vigor slows and structural diversity develops. As a general rule, the larger forested areas of mature seral stages are not accessible by roads. In the lower elevations, or where roads access an area, more early (0 to 10 years) and mid-seral (10 to 40 years) vegetation is found.

Fire is an essential ecosystem process that sometimes has large-scale effects. Fire suppression is the primary reason that the succession of plant communities has progressed towards climax conditions. Currently, the primary influences on the dynamics of forest stand structure are drought and the smaller scale natural processes of frost action, plant succession, bark beetle infestations, forest pathogens, the encroachment of non-native species, wind, and animal damage. All of these processes are slowly shifting the forests from the stem exclusion stage to the understory reinitiation stage and old-growth stages of forest stand development. Silvicultural practices may help to speed up the forest stand development process and maintain certain plant communities.

PLANT SPECIES AND HABITATS

Non-Native Plant Species and Noxious Weeds

There are innumerable non-native plant species established in the watershed. Many of these are on the valley floor and in the low foothills where human disturbance has been most intense and climate is most favorable for the invaders, but they have also followed the roads, power lines, and other access corridors to the ridges. They can also be found in moist mountain meadows at higher elevations and other disturbed open areas where seeding has occurred in the past.

Noxious weeds designated by the Oregon Department of Agriculture (ODA) are divided into three groups: "T" (target list which are the highest priority for control), "A" (second highest priority for control), and "B" (third highest priority for control). While the entire watershed has not been inventoried, noxious weed species known to occur include St. Johnswort (Klamath weed) ("B"), yellow starthistle ("T"), and medusahead wildrye ("B"). Other noxious weeds that are known to occur in the surrounding area and have the potential to spread to the Klamath-Iron Gate Watershed are: Canada thistle ("A"), purple starthistle ("A"), dyers woad ("B"), dodder ("B"), diffuse knapweed ('B"), squarrose knapweed ("T"), leafy spurge ("B"), tansy ragwort ("B"), spotted knapweed ("T"), and dalmation toadflax ("B").

Other non-native species that have not been designated as noxious weeds by the ODA have also been seen in the Klamath-Iron Gate Watershed: ripgut brome, cheatgrass, bulbous bluegrass, and hedgehog dogtail. Descriptions of the noxious weed species that have been found in the watershed and those species posing a threat are presented in Appendix B.

Special Status Plant Species and Habitats

Thirteen populations (three species) of special status vascular plant species are known to exist in the Klamath-Iron Gate Watershed. Special status plants are those species whose survival is of concern due to: 1) their limited distribution, 2) low number of individuals or populations, and 3) potential threats to their habitat. Generally, it is BLM policy to manage for the conservation of special status plants and their associated habitats and ensure that actions authorized, funded, or carried out do not contribute to the need to list any species as threatened or endangered.

Management categories for special status plant species:

1) listed as threatened or endangered by the U.S. Fish and Wildlife Service (USFWS).
2) proposed for listing as threatened or endangered by the USFWS.
3) identified as candidates for listing as threatened or endangered by the USFWS.
4) listed as threatened or endangered by the Oregon Department of Agriculture (ODA).
5) identified as candidates for listing as threatened or endangered by the ODA.
6) designated as Sensitive in Oregon by the BLM.
7) designated as Assessment in Oregon by the BLM.
8) designated as Tracking in Oregon by the BLM.

9) designated as Watch in Oregon by the BLM.

Rules, guidelines and recommendations for managing these species are addressed in the Endangered Species Act of 1973, Oregon Administrative Rule 603-073, BLM Manual Section 6840. Also, one plant in California is managed as a Redding BLM Sensitive species and is on the California Native Plant Society List 1B: Plants Rare, Threatened or Endangered in California and Elsewhere. Plants on List 1B meet the definitions of Sec. 1901, Chapter 10 Native Plant Protection Act (NPPA) or Secs. 2062 and 2067 California Endangered Species Act (CESA) of the California Department of Fish and Game Code, and are eligible for state listing. These species must be considered during preparation of environmental documents relating to the California Environmental Quality Act.

Survey and Manage Plant Species and Habitats

Four sites (three species) of Survey and Manage plants are known to exist in the Klamath-Iron Gate Watershed. Survey and Manage plant species include species of vascular plants, mosses, liverworts, hornworts, lichens, and fungi. Fungi are included in the plant group however taxonomically they are considered a separate kingdom. The standards and guidelines for these species are addressed in the Northwest Forest Plan (USDA and USDI 1994a) and are designed to benefit these species.

The four survey strategies, or components, are:

1) manage known sites. Highest priority with appropriate action usually, protection.
2) survey prior to ground-disturbing activities. Designed to locate new sites of rare species and establish management sites.
3) conduct extensive surveys. Designed for difficult to survey for species.
4) conduct general regional surveys. Designed to gather information for species particularly poorly known.

In addition, Protection Buffer species also have standards and guidelines. These species are rare, locally endemic, and other specific species in the upland forest matrix.

Management recommendations have been developed for 12 species of vascular plants (BLM Instruction Memorandum (IM) OR-99-27), five species of bryophytes (IM OR-99-039), and 151 species of fungi (IM OR-98-003). Draft management recommendations are being reviewed for 18 species of bryophytes (IM OR-97-027). Species without management recommendations would use information in Appendix J2 of the *Final Supplemental Environmental Impact Statement on Management of Habitat for Late-Successional and Old-Growth Forest Related Species Within the Range of the Northern Spotted Owl* (USDA and USDI 1994b).

FIRE AND AIR QUALITY

Fire is recognized within the Northwest Forest Plan as a key natural disturbance process throughout the Cascade Mountain Geologic Province. An areas' fire regime is determined by the combination of climate, topography, and vegetation. Fire regime is a broad term that includes fire type, intensity, size, and return interval.

There are two broad categories of fire regimes within this watershed: low and moderate. A low severity regime is characterized by frequent fires of low intensity with a fire return interval typically less than 25 years. Moderate-severity regimes are characterized by less frequent fires (25 to 100 years) and burn with different degrees of intensity. Stand replacement fires occur within this regime as well as low intensity fires. The overall effect of fire on the landscape is a mosaic burn.

Vegetation zones are helpful in delineating fire regimes. The zones listed in Table 5 are taken from Vegetation of Oregon and Washington (Franklin and Dyrness 1973).

Table 5. Vegetation Zones by Elevation

[illegible] (feet)	[illegible] Cascade Vegetation Zone
6,562-4,811	White Fir/Shasta Red Fir
4,811-3,058	Mixed Conifer
3,058-1,419	Interior Valley

The elevation range within this watershed is 2,330 to 6,091 feet. The Interior Valley Vegetation Zone at the lower elevations within the watershed are classified as a low severity regime. Currently much of the lower elevation areas have dense shrubs, hardwoods and scattered conifer vegetation conditions. Fires within the shrub and hardwood areas were widespread and frequent and burned with lower intensity. Fire effects to vegetation with low severity fires generally maintained vegetation conditions across the landscape.

The Mixed Conifer Vegetation Zone in the mid-elevations and the drier portions of the White and Red Fir Zones are classified as a moderate fire regime. Fire return intervals for these areas range from 8 to 125 years with an average of about 35 years. Fire effects to vegetation with moderate severity fire are generally a mosaic of low severity and stand replacement fire across the landscape.

Air quality within the watershed is influenced by weather conditions and emissions sources. Emission sources that are most likely to adversely affect the air quality at the watershed scale are likely to be fires within the region during the summer months. Prescribed burning operations may produce local impacts to air quality during the fall, winter, and spring months. Prescribed burning operations within the watershed are usually managed to reduce the likelihood of smoke impacts to populated areas such as the Medford-Ashland area.

TERRESTRIAL WILDLIFE SPECIES AND HABITATS

There are approximately 260 terrestrial vertebrate wildlife species known or suspected to be present in the Klamath-Iron Gate Watershed. Nelson (1997) documented the presence of 138 wildlife species in the Soda Mountain Wilderness Study Area (WSA) which is within the Klamath-Iron Gate Watershed. In addition to the verified species, Nelson (1997) postulated that an additional 81 species are probably present in the WSA. Also, approximately 40 waterfowl and shorebird species are likely associated with Iron Gate Reservoir. The estimated total number of species includes both resident and migratory species.

Vegetation in the WSA is characteristic of that found throughout the watershed, so the species verified and predicted by Nelson (1997) should be representative of the entire watershed. The dominant plant communities providing habitat for the numerous terrestrial wildlife species found in the Klamath-Iron Gate Watershed are mixed conifer, temperate coniferous, deciduous hardwood, grass-forb dry hillside, and mountain shrubland and chaparral as described by Brown (1985).

Northern spotted owls and bald eagles, both listed as threatened under the auspices of the Endangered Species Act of 1973, as amended, are present in the watershed. There are 3 northern spotted owl nest sites/activity centers. There are no known bald eagle nest sites in the watershed, but they are known to forage around Iron Gate Reservoir. Approximately 7,025 acres of the watershed are in northern spotted owl critical habitat unit (CHU) OR-38.

Nineteen special status species (see Table C-1, Medford District Record of Decision and Resource Management Plan, 1995) are known or are likely to be present in the watershed: 3 reptiles, 12 birds, and 4 mammals. These species are either federally-listed as threatened, or are BLM sensitive or assessment species. Two of the bat species designated for protection in the Northwest Forest Plan (USDA and USDI 1994a) are known to be present in the watershed: long-eared myotis and long-legged myotis.

A large portion of the Jenny Creek deer winter range and a smaller portion of the Jenny Creek elk management area are in the watershed. Also, the Horseshoe Ranch Wildlife Area in California is within the watershed. The "ranch" is comprised of California Department of Fish and Game (CDFG) land and intermingled BLM managed land. Under a Sykes Act agreement a Wildlife Habitat Management Plan was developed by CDFG and BLM for management of the "ranch". The primary objective identified in the plan is to improve wildlife habitat conditions, in particular, deer winter range condition for the Jenny Creek Interstate Deer Herd (McClain 1983).

HYDROLOGY

For purposes of the hydrology discussion, the Klamath-Iron Gate Watershed is stratified into four subwatersheds: Fall Creek, Camp Creek, Scotch Creek, and Iron Gate (Map 9).

Hydrologic Features

Groundwater supplies in the watershed are unknown.

Surface water in the watershed includes streams, springs, wetlands, reservoirs, and ditches. There are approximately 294 stream miles in the watershed. Fall Creek is a fourth order stream at its confluence with the Klamath River and Camp and Scotch Creeks are fifth order streams where they enter the Iron Gate Reservoir. Scotch Creek Subwatershed has the highest stream density in the watershed.

Table 6 displays area, ownership, stream miles, and stream density by subwatershed.

Table 6. Ownership and Stream Information by Subwatershed

Subwatershed	Area (acres)	Area (sq. mi.)	Ownership (percent)			Total Stream Miles	Stream Density (mi./sq. mi.)
			BLM	State	Private		
Fall Creek	9,877	15.4	19	0	81	46.2	3.0
Camp Creek	12,579	19.7	68	1	31	103.8	5.3
Scotch Creek	11,503	18.0	61	30	9	109.5	6.1
Iron Gate	8,401	13.1	7	5	88	34.9	2.7
Watershed Totals	42,360	66.2	42	10	48	294.4	4.4

Source: Medford BLM Geographical Information System (GIS)

Table 7 displays stream miles by subwatershed and by Northwest Forest Plan stream category (fish-bearing, permanently flowing nonfish-bearing, and intermittent streams) for BLM-administered lands. None of the nonfish-bearing streams and only a portion of the fish-bearing streams have been inventoried to determine whether they are permanently flowing or intermittent. However, an approximation based on aerial photos was made to estimate miles of perennial and intermittent streams. Stream categories are shown on Map 10.

Table 7. Stream Miles by Stream Category for BLM-Administered Lands

Subwatershed	Northwest Forest Plan Stream Category for Riparian Reserves			Total Stream Miles with Riparian Reserves
	Fish-bearing Streams Miles	Perennial Non-fish-bearing Streams Miles	Intermittent Streams Miles	
Fall Creek	2.7	0.6	5.3	8.6
Camp Creek	5.8	7.0	65.5	78.3
Scotch Creek	4.7	5.5	60.0	70.2
Iron Gate	0.2	0	1.6	1.8
Total	13.4	13.1	132.4	158.9

1/ Stream category estimated from aerial photos.
Source: Medford BLM Geographical Information System (GIS)

Wetlands identified by the U.S. Fish and Wildlife Service in their 1984 National Wetlands Inventory are shown on Map 11. Wetlands in the California portion of the watershed have not been mapped. Wetlands in the Oregon portion of the Klamath-Iron Gate Watershed are classified as palustrine (ponds) or riverine systems. Table 8 summarizes information by subwatershed for palustrine systems. Additional wetlands may be located during site-specific project analysis.

Table 8. Wetlands

Subwatershed	Palustrine System[1]	
	Acres	Number
Fall Creek	15.0	9
Camp Creek	3.3	8
Scotch Creek	0.8	2
Iron Gate	NA	NA
Total[1]	19.1	19

1/ Wetland information only available for watershed lands in Oregon.
Source: USFW National Wetlands Inventory (1984)

Iron Gate is the only major reservoir within the watershed. Iron Gate Reservoir, dedicated on January 13, 1962, is an instream impoundment on the Klamath River that is owned and operated by PacifiCorp (formerly Pacific Power and Light). It is part of a three-dam complex that also includes Copco and John C. Boyle dams upstream of Iron Gate on the Klamath River. The impoundment behind Iron Gate Dam covers 975 acres, has 58,000 acre feet of storage capacity, and has a maximum depth of 173 feet. The full pool elevation of the lake is 2,338 feet (Boyle 1976). The project is operated as a re-regulating reservoir to offset peak flows that are discharged from the hydroelectric projects upstream of Iron Gate. It also produces electricity, but has no flood control benefits.

There are also a few small reservoirs on private ranches in the Fall Creek Subwatershed.

Hydrologic Characteristics

The only operational United States Geological Survey (USGS) streamflow gaging station within the watershed is located on the Klamath River below Iron Gate Dam. The streamflow information from this gaging station reflects the regulated nature of the Klamath River and does not depict hydrologic conditions in the Klamath-Iron Gate Watershed. Reservoir levels are regulated by PacifiCorp for power generation. The USGS operated a gaging station on Fall Creek below the fish hatchery from 1929 to 1959. During this time there was a diversion from Fall Creek for irrigation in T.48N., R.5W., Section 25 above the gaging station. Approximately 4 cubic feet per second (cfs) were diverted from Spring Creek (tributary to Jenny Creek) to Fall Creek by Pacific Power and Light Company (now PacifiCorp). Table 9 summarizes information for the two stations.

Table 9. USGS Gaging Stations

Station	Period of Record (water year)	Drainage Area (mi.²)	Extreme Discharge		Average Annual Flow (cfs)	Average Annual Runoff (acre-feet/yr.)
			Maximum (cfs)	Minimum (cfs)		
Below Iron Gate Dam	1960-1997	4,630	29,400	389	2,106	1,526,000
Fall Creek	1929-1959	14.6	875	3.6	39.1	28,277

Source: U.S. Geological Survey Water Resources Data (USGS 1997)

Streamflow in the Klamath-Iron Gate subwatersheds fluctuates with seasonal variation of precipitation. Moderate to high flows generally occur from mid-November through May. Streamflows during the months of April and May and part of June are augmented by melting snowpack in the high elevations. Low flows normally coincide with the period of low precipitation from July through October.

The City of Yreka has a 1967 permit from the California State Water Resources Control Board to divert up to 15 cfs from Fall Creek for domestic, industrial, and municipal use. The Yreka water supply system was constructed in 1968 and 1969 with the system operational on August 21, 1969. The Yreka water system on Fall Creek consists of a diversion and pumping station located below the penstock for the PacifiCorp generator a short distance from the mouth of Fall Creek. The water allocated for municipal purposes is pumped 23 miles from the Fall Creek diversion to the City of Yreka (Shaddox 1999).

STREAM CHANNEL

The Klamath-Iron Gate Watershed includes Iron Gate Reservoir and its tributaries (Scotch, Camp, and Fall Creeks), excluding Jenny Creek, and a short section of the Klamath River between Fall Creek and Copco Dam. Each major tributary drains a relatively small area, and none of the stream systems are as long as ten miles. The major streams in this watershed flow from the north, northwest, or northeast across the Oregon border into California then into the reservoir.

Streams that enter Iron Gate Reservoir from the south are limited to small seasonal washes. Long Gulch is the only stream that is named on USGS maps. It is a short watershed with moderate gradient that encompasses about two square miles.

The Level I Rosgen stream channel morphology classification system (Rosgen 1996) was used to classify streams in the watershed. Channel types are summarized in Table 10 and discussed in greater detail in Current Conditions. Appendix C provides descriptions of Rosgen morphological stream types. Map 12 shows Rosgen stream channel typing for streams in the watershed.

Table 10. Stream Channel Types

[illegible]	A1+ (miles)	A (miles)	B (miles)	C (miles)	Total Stream Miles
Fall Creek	14.1	9.8	22.3	0.0	46.2
Camp Creek	67.0	17.7	19.1	0.0	103.8
Scotch Creek	74.1	10.2	25.2	0.0	109.5
Iron Gate	17.5	4.4	12.2	0.8	34.9
Totals	172.7	42.1	78.8	0.8	294.4

Source: Medford BLM Geographical Information System (GIS)

Channel characteristics in the three major tributaries are similar in many respects, but there are major differences. For instance, the lower reaches of Scotch and Camp Creeks have low to moderate gradients with steep headwater streams. Fall Creek differs in that it is steep in the lower portion, but flattens out above the Oregon border and continues with a low to moderate gradient until it reaches the headwater portions. Substrate material in Scotch and Camp Creeks and lower Fall Creek is cobble and boulders over bedrock with some gravel and fines. Upper portions of Fall Creek contain fines and small gravel. Stream channels in Camp and Scotch Creeks are mostly entrenched and confined in V-shaped valleys with steep hillslopes. There is a high degree of bank erosion. Riffles and cascades dominate the average stream profile. Upper Fall Creek again is the exception where it flows through a relatively flat valley. Deep pools, those over three feet deep, are lacking in most stream reaches in the watershed as is large woody material.

WATER QUALITY

The 1957 Klamath River Basin Compact between Oregon and California recognizes the following beneficial uses: domestic water supply; livestock watering; irrigation; protection and enhancement of fish, wildlife and recreational resources; industrial; hydroelectric power production; navigation; and flood prevention (OWRD 1997). The designation of beneficial uses is important because it determines the water quality criteria that will be applied to that water body. Water quality standards are typically designed to protect the most sensitive beneficial uses within a waterbody. The most sensitive beneficial uses for the Klamath-Iron Gate Watershed are the protection and enhancement of fish resources and domestic water supply. Flow modifications, temperature, dissolved oxygen, pH, nutrients, bacteria/pathogens, turbidity, sedimentation, and habitat modifications are the key water quality indicators most critical to these sensitive beneficial uses.

Fall Creek is the source of municipal water supply for the City of Yreka.

RIPARIAN AREAS

Riparian vegetation at lower elevations in Camp and Scotch Creeks is confined to narrow corridors on either side of the perennial streams, especially in areas characterized by narrow V-shaped valleys and steep hillslopes. Tree and shrub growth in these corridors is fairly thick and provides good shading. Hardwoods make up most of the overstory. Understory vegetation is a variety of brush species, grasses and forbs.

Riparian vegetation in these two subwatersheds transforms to other species as elevation increases. Douglas-fir becomes more common near the Oregon border. Further up the slope this vegetation changes to expanses of roseaceous chaparral. At the highest elevation, headwater drainages are encompassed in fairly continuous coniferous forest dominated by white fir.

The lower reaches of Fall Creek have similar riparian vegetation as found in Camp Creek and Scotch Creek Subwatersheds, however, near the Fall Creek Ranch it transforms to a mixed conifer-hardwood plant community. Headwater reaches on the slopes of Parker and Grizzly Mountains are encompassed in uninterrupted conifer stands.

The Northwest Forest Plan (USDA and USDI 1994a) provides interim Riparian Reserve widths for streams, lakes, ponds, and wetlands (Standards and Guidelines, page C-30). These widths are adopted for water bodies in the Klamath-Iron Gate Watershed. Map 13 shows Riparian Reserves in the watershed.

AQUATIC WILDLIFE SPECIES AND HABITATS

A great variety of fish species inhabit the Klamath-Iron Gate Watershed. Major streams in the watershed area support healthy populations of native rainbow trout, however, native fish may have been replaced by trout of hatchery origin in lower reaches of these streams. Chinook salmon and steelhead migrated up the Klamath River above the Oregon border prior to the construction of dams and steelhead reportedly used lower portions of Camp and Fall Creeks below barriers prior to the construction of Iron Gate Dam. These anadromous fish are now intercepted at a State operated fish hatchery at the base of the dam. Iron Gate Reservoir supports a mixture of game and nongame fish. The range of some native nongame fish may extend into lower reaches of major streams. Map 14 shows fish distribution for the Klamath-Iron Gate Watershed.

Camp Creek is known to host healthy and somewhat unique populations of aquatic insects and one aquatic snail. Other endemic snails reside in Fall Creek.

Major streams in the watershed have ample shading and cool water supplies that provide suitable conditions for resident trout. Dwindling water supply in late summer results in some lower stream sections to become dry. Good rearing habitat for juvenile fish, such as holes deeper than three feet, are lacking. Large woody material is also lacking in most reaches. Suitable spawning gravel is in short supply in upper reaches. Elsewhere gravels are often choked with fines and sediment.

CURRENT CONDITIONS

The purpose of the Current Conditions section is to develop information relevant to the identified Issues and Key Questions. The Current Conditions section provides more detail than the Characterization section and documents the current conditions and trends of the relevant ecosystem elements.

HUMAN USES

Current Human Uses and Trends

The Bureau of Land Management (BLM), Ashland and Klamath Falls Resource Areas and Redding Field Office, manages 18,075 acres of land within the Klamath-Iron Gate Watershed. The State of California, the California Land Conservancy, PacifiCorp, and various other private landowners also own or manage land in the watershed. Other groups or individuals with an interest in the watershed include the City of Yreka, allotment permittees, various groups concerned with Soda Mountain Wilderness Study Area (SMWSA), the Pacific Crest National Scenic Trail, and the Cascade/Siskiyou Ecological Emphasis Area (CSEEA).

Major human uses of the watershed include: use by local ranchers for grazing; camping and recreation at the Iron Gate Reservoir facilities and along the Pacific Crest National Scenic Trail; timber harvest; and power generation at PacifiCorp facilities. The area is also used for hunting and fishing, off-highway vehicle (OHV) recreational use, and by horseback riders.

Facilities and Structures

There are two Oregon Department of Forestry (ODF) fire lookouts which overlook portions of the Klamath-Iron Gate Watershed. One is Parker Mountain, a prominent peak in the extreme northeast of the watershed and the other is Soda Mountain in the northwest part of the watershed. Parker Mountain Lookout is located on private timber company land just east of a BLM parcel. It is in the NE1/4 of Section 7, T. 40 S., R. 5 E., W.M. in Klamath County, Oregon. The summit of the mountain is over 5,000 feet elevation. The road leading to the site crosses the same private land on which the lookout is located. BLM has no direct control of the lookout or the road leading to it, however, BLM has installed a Remote Automated Weather Station (RAWS) on Parker Mountain.

In contrast to Parker Mountain, Soda Mountain Lookout is on BLM-managed land. It is located in the NW1/4 of Section 28, T. 40 S., R. 3 E., W.M. in Jackson County, Oregon. The peak is over 6,000 feet in elevation. Access to the site is from the north over existing BLM roads located in the Bear Creek Watershed. From the lookout on the summit of the mountain, there are excellent views in all directions which explains why ODF chose Soda Mountain as a site years ago. Over time, other agencies and companies have recognized the value of Soda Mountain for use as a communication site. Consequently, there are now many authorized users on the mountain with an array of buildings, towers, plus transmitting and

receiving devices. The bulk of this equipment is located on the ridge running to the southwest of the fire lookout. This ridge forms the common boundary between the Klamath-Iron Gate and Bear Creek Watersheds. More facilities may be added to the site if they are found to be compatible with the existing uses.

Other authorized "facilities" which are located within the watershed are two major electrical transmission lines, owned and operated by PacifiCorp. These lines cross through the watershed on a mix of public and private lands. They are an integral part of the electrical grid system which serves the public in Oregon and California. Attached to one of these lines is a PacifiCorp fiber optic line. This line was analyzed and approved by BLM as a compatible use under the transmission line right-of-way grant.

Facilities located on non-federal lands within the watershed include a dam and reservoir, campgrounds and picnic areas, boat ramps, a fish hatchery, a power house, a penstock, a diversion dam, canals, a city water system with intake structure and pumps, a gaging station, etc.

Authorized and Unauthorized Uses

Three other Oregon BLM authorizations have been granted for permitted uses within the Klamath-Iron Gate Watershed. There is one road right-of-way authorization, one right-of-way grant for a buried electrical utility line, and one right-of-way grant for a small water development for domestic use. These authorized uses include two private parties and a utility company providing service to a commercial facility on private land.

There are no known unauthorized uses of public land within the Oregon portion of the analysis area. However, some of these uses may exist. When discovered, BLM establishes case files and works to resolve the situation in accordance with BLM policy and directives.

Land Exchanges/Sales/Transfers

The Medford District BLM is working to complete an ongoing exchange with a private timber company for a 160 acre parcel of land partially within the Klamath-Iron Gate Watershed. Once completed, the exchange will serve to consolidate BLM ownership near Pilot Rock, an Oregon landmark. That portion of the 160 acres which is not in the watershed is located in the adjacent Upper Bear Creek Watershed Analysis Area to the north.

A second Medford District land exchange has been initiated for two parcels of private timber land holdings in Sections 28 and 34 of T. 40 S., R.3 E., W.M. in Jackson County, Oregon. Once this exchange is completed, it will serve to consolidate BLM ownership near Soda Mountain.

The BLM, Redding Field Office has identified a number of isolated parcels within the watershed that are surplus to their needs and available for exchange. These parcels were identified through their planning process, completed in 1993. The various parcels comprise approximately 1,120 acres of public land scattered throughout the California portion of the

watershed. On certain parcels all clearances have been completed and no special resources need protection. Other parcels have important resource values which would need permanent protection under an exchange agreement. At this time, all of these parcels (except two) have been placed in an "assembled land exchange" by the Redding Field Office. Title to one of the parcels in the assembled exchange package has been transferred as of this date. The two parcels not included in the assembled land exchange package are available for disposal through other exchange action.

The BLM, Redding Field Office has also identified several sections of public land within the watershed for transfer to a State agency. All of these sections are in proximity to the Horseshoe Ranch Wildlife Area which is managed by the State of California Department of Fish and Game. The goal of the transfer is to have the State manage these nearby public lands in concert with their wildlife management program for Horseshoe Ranch Wildlife Area.

No sales of public lands have occurred in the Oregon portion of the watershed in recent years and no sales are anticipated for the foreseeable future.

Easements

The Pacific Crest National Scenic Trail, part of the National Trail System passes through portions of the Klamath-Iron Gate Watershed as well as the adjoining Bear Creek Watershed. Due to the significance of this trail system, BLM has acquired a number of easements for this trail over various private lands within the two watersheds. These easements grant right of passage to the public for the intended use i.e. hiking.

Transportation System

The BLM's Geographical Information System (GIS) and Transportation Information Management System (TIMS) identify approximately 130 miles of road within the Klamath-Iron Gate Watershed of which 38 percent are controlled by BLM. Roads in the watershed vary from primitive four wheel drive roads to paved highways. BLM roads were constructed and are maintained for log hauling and administrative purposes. BLM inventories contain very little information about non-BLM controlled roads. Most of the county roads have a bituminous surface and the private roads are usually either rocked or are left unsurfaced.

Road maintenance is conducted by the different owners and management agencies. Water, oil, or lignin are usually applied to road surfaces when hauling during dry periods for dust abatement and to keep roads from disintegrating. There are developed water sources in the watershed where the BLM may obtain water. Water is used when placing surface rock and for road maintenance, which allows for proper processing and reduced segregation of the road surface rock.

The BLM charges fees for commercial use of roads and then uses these fees to help pay for road maintenance. A reduction in timber harvest levels has resulted in a significant decrease in the primary funding source for maintaining the transportation system. Many roads previously maintained at a high level are not being maintained to that extent any longer. To reduce

maintenance requirements and erosion potential, some unnecessary roads have been, or will be, decommissioned. Other roads are closed until future access is needed and many others are maintained at the lowest possible levels. BLM roads have a maintenance level assigned to them. The roads are monitored and the maintenance levels are modified when needs and conditions change. Maintenance levels range from minimal standards on short roads to high standards on main roads. Sharing and maintaining roads with landowners has also reduced the amount of road necessary for access and maintenance costs. The goal is to maintain the entire transportation system in a safe and environmentally sound condition. The result is a transportation system that provides for various recreational activities, private access, logging, fire fighting access, and other land management uses.

Road maintenance includes removing safety hazards, reducing soil erosion potential and providing for fish passage at all potential fish-bearing stream crossings. Safety hazards include hazard trees that have the potential to fall on houses, recreation areas, or roadways. Hazard trees are usually dead, but may be alive with roots under-cut or with significant physical damage to the trunk or root system. Proper maintenance of road drainage systems and stream crossing culverts is essential to avoid both erosion and fish passage problems. Most of the existing culverts were designed to withstand 50-year flood events. New drainage structures will be designed to withstand a 100-year flood event and when appropriate, provide for fish passage. Road protection measures include constructing drainage structures, grass seeding, blocking roads, placing road surface rock, and applying bituminous surfacing.

Most rocked roads are located in the eastern portion of the watershed. The western and southern portions have more natural surfaced roads which include jeep roads. Some roads are maintained at very low levels or not at all. Roads are like any other facility, they need to be maintained to function as designed. Roads that have been maintained are in good shape.

Part of the Schoheim road (BLM road 41-2E-10.1) and its spurs are in very bad condition due to lack of maintenance. This lack of maintenance is a result of public efforts to expand the SMWSA (see Recreation). Those in support of expanding the SMWSA would like to see the Schoheim road decommissioned. The future management of the Schoheim road will be determined as an outcome of the Cascade/Siskiyou Ecological Emphasis Area Environmental Impact Statement (EIS)/Plan that is being developed during the fall of 1999.

BLM roads are generally open for public use unless blocked by gates or other methods. Gates and other road barriers regulate vehicle access to reduce maintenance costs, soil erosion, transfer of noxious weeds, and wildlife disturbance.

High road densities are discussed in the Erosion Processes and Hydrology sections.

Logging

The most recently advertised timber sales on BLM-managed lands in the Klamath-Iron Gate Watershed were the Copco and Hobart Peak sales. Table 11 reflects data from the prospectus of these sales. The Copco sale was completed in Oct. 1989 and the Hobart Peak sale was completed in Oct. 1991. There are no timber sales planned in this watershed through the fiscal

year 2002.

Table 11. Most Recent BLM Timber Sales in the Klamath-Iron Gate Watershed.

Sale Name	Date Advertised	Location	Unit No.	Harvest Type[1]	Harvest Method	Acres	Volume Removed (MBF[2])
Copco	7/28/88	T40S, R4E, SEC. 35	3	OR/MS	Tractor	52	326
Hobart Peak	8/30/90	T40S, R3E, SEC. 27	2, 3B, 4	SC	Cable	65	560
			3A	SC	Tractor	8	50

1/ MS= Mortality Salvage SC= Select Cut OR= Overstory Removal
2/ MBF = thousands of board feet

Table 12 summarizes acres harvested on BLM-managed lands in the watershed by harvest type and volume removed each decade since 1940.

Table 12. Acres Harvested and Volume Removed on BLM-Managed Lands

Decade of Sale	Clearcut Acres	Select-cut Acres	Salvage Acres	Shelter-wood Acres	Over-story Removal Acres	Thinning Acres	Volume Removed (MMBF[1])
1940s	0	509	0	0	0	0	5.5
1950s	0	477	0	0	0	0	2.4
1960s	0	25	0	0	0	0	0.3
1970s	0	421	0	0	0	0	3.0
1980s	30	2	0	0	530	464*	6.3
1990s	0	73	0	0	0	0	0.7

1/ MMBF = millions of board feet
* Same acres included in OSR (combination overstory removal and commercial thin)

Table 12 reflects BLM forest inventory data (Micro*Storms database) as of January 28, 1999. This data may not be complete because all historic data may not have been input into the system. According to the inventory data, a total of 2,067 acres have been harvested since the 1940s on BLM-managed lands within the Klamath-Iron Gate Watershed. Approximately 625 of these acres were entered more than once. This means that only 8 percent of the available BLM land base within the watershed has been harvested. Most of these acres were harvested using a select cut.

Oregon Department of Forestry's Notification of Operations database (1990-1999) was referenced in order to investigate logging and other operations conducted on private land within the watershed. This database only contains the location, operator/land owner, year, activities, methods used, and acreage for proposed operations. The operator/land owner may deviate from the planned operation. Because of this potential for deviation, only general

information is available regarding operations within the watershed.

Most of the notifications fell into one of the following categories: 1) herbicide, insecticide, rodenticide, fertilizer, and fungicide application; 2) road construction/reconstruction and 3) harvesting. Herbicides, insecticides, rodenticides, fertilizers and fungicides have been used by private landowners throughout the watershed at different levels of application. Even though no quantitative or qualitative studies are available at this time it is important to note the usage of these chemicals. No new roads were constructed but approximately 3.3 miles of road were reconstructed in 1994 in Sections 23 and 24 of T40S, R4E, W.M. The third category, harvesting, consisted of two different harvest types: 1) commercial thinning and 2) most, or all, conifer timber or large hardwoods will be cut and removed from the unit during harvesting. From 1990-1999, 4,618 acres of commercial thins were harvested or planned for harvest from private lands in the watershed. During the same period only 514 acres of the second type of harvest was planned. These forestry operations have potential impacts to the whole watershed that should be considered when doing projects on the ground.

Special Forest Products

The BLM is working with the Forest Service to develop regional and national strategies that recognize the importance of managing special forest products (SFPs). These strategies emphasize four themes: 1) to incorporate harvesting of SFPs into an ecosystem management framework with guidelines for sustainable harvest, species conservation, and protection of ecosystem functions; 2) to involve the public including industrial, Native American, and recreational users of these resources in making decisions about the future of SFPs on public lands; 3) to view the management of an accessibility to SFPs as major factors in assisting rural economic diversification in formerly timber-dependent communities; and 4) to develop and implement inventory, monitoring, and research programs to ensure species protection and ecosystem health (Molina et al. 1997).

Due to the watershed's limited access and distance from the Rogue Valley, demand for SFPs has been very low to non-existent. No change is anticipated to this demand, therefore SFPs are not considered a major concern.

Grazing/Agriculture

Cattle operations are the number one agricultural commodity in Oregon, contributing 12.8 percent of the total gross value of agricultural products; Jackson County ranks 16th in the state for gross farm and ranch sales (Andrews 1993). Within the watershed, cattle operations are the largest non-forestry agricultural venture. Eighty-one percent of the BLM-managed lands are allocated to four grazing allotments managed by three district offices in Oregon and California. The Klamath-Iron Gate Watershed is designated as open range. Table 13 summarizes grazing use on BLM-administered lands in the watershed. Appendix D summarizes allotment information for the watershed and Map 15 shows allotment boundaries.

Table 13. Grazing Information for BLM-Administered Lands[1]

BLM District	Number of Allotments	Total Acres Managed	Total Acres Grazed	Total Preference (AUMs)[2]	5 Year Avg. Actual Use[3]
BLM (OR) Medford and Lakeview Districts	2	13,698	13,698	2,209	1,623
BLM (CA) Ukiah District	2	4,306	870	89	17
Totals	4	18,004	14,568	2,298	1,640

1/ as of January 1999.
2/ AUMs = animal unit months.
3/ Actual Use (1994-1998)

Federal grazing allotments are categorized for management requirements. Categorization concentrates funding and personnel where management is needed most. The following are the categories for prioritizing the allotments: 1) improve - the allotment will be managed intensively for improvement; 2) maintain - current management will be sufficient to maintain conditions that are satisfactory; and 3) custodial - a minimum amount of effort will be expended to maintain existing resources, often due to a large percentage of private lands.

The primary goal of the rangeland management program is to provide livestock forage as one of the many uses of the public lands while maintaining or improving rangeland conditions and riparian areas. Grazing management includes, but is not limited to, establishing preference, season of use, and permitted use under the grazing permit or lease. Preference is a priority position against others for the purpose of receiving a grazing permit/lease. This priority is attached to base property owned or controlled by the permittee/lessee. Season of use indicates the period during which cattle are allowed on the range. Permitted use indicates the forage allocated for livestock grazing and is measured in animal unit months (AUMs). An animal unit month (AUM) is the amount of forage required to sustain one cow or its equivalent during a one-month period. At present, no allotment within the watershed is leased for horses or sheep. Total preferences for BLM-administered lands are shown in Table 13. A coordinated management plan has been completed for the Soda Mountain allotment.

Range Monitoring

The primary purpose of rangeland monitoring is to evaluate the effects of livestock grazing on vegetation communities. Forested sites that have been disturbed by past logging practices are referred to as transitional areas. Trend studies to monitor these disturbed forested areas for livestock affects is impractical from a rangeland monitoring standpoint. Grasslands, shrublands, meadows, and oak woodlands are more appropriate for rangeland monitoring.

One of the primary long-term rangeland studies is trend. Trend describes the direction of change in range condition based upon plant frequency. Frequency describes the abundance and distribution of species and is useful to detect changes in plant communities over time. Other current studies include forage utilization, riparian and upland photo points, and

precipitation data.

In August of 1997, the BLM adopted new rules for rangeland health (USDI 1997). Rangeland health can be defined as the degree to which the integrity of the soil and ecological processes of rangeland ecosystems are sustained. Additional studies and indicators for each standard of rangeland health will be developed in the future. These studies will relate to the functioning of both uplands and riparian systems.

Wild Horses

Copco Reservoir is the southern boundary of the 80,885 acre Pokegama Wild Horse Management Area. The other boundaries are the upper Klamath River to the east, Jenny Creek to the west, and Highway 66 to the north. The Pokegama wild horse population has been around since the turn of the century. Apparently the size of the herd has been relatively small in number and has been residing in this general area since its beginnings. BLM controls 20 percent of the management area with responsibilities for the herd assigned to the Klamath Falls Resource Area, Lakeview District. The management level for the herd is set at 30 to 50 head (USDI 1995b). The primary area of horse activity within the Klamath-Iron Gate Watershed occurs in the Fall Creek drainage on the Dixie Allotment.

Mineral Resources

At the request of the BLM, the U.S. Geological Survey (USGS) undertook a mineral resources study of the Soda Mountain Wilderness Study Area which is within the Klamath-Iron Gate Watershed. The USGS report (Pickthorn et al. 1990:C1) concluded that "much of the northern part of the study area has moderate potential for gold and silver. The study area has a low potential for geothermal resources. The study area has low resource potential for oil and gas and building stone; a small area in the south has low potential for gold in placer deposits."

At this time, there are no valid mining claims on Medford District BLM-managed lands in the watershed.

Recreation

The Klamath-Iron Gate Watershed receives recreational use year-round, and although recreational use of the area is increasing it is not increasing as rapidly as elsewhere on the Medford District.

Recreational opportunities include the Pacific Crest National Scenic Trail (PCNST), the Bean Cabin, Pilot Rock, the Soda Mountain Wilderness Study Area (SMWSA), and numerous campgrounds and day-use areas around Iron Gate Reservoir. The PCNST is maintained yearly to remove blowdown from the trail and a 100 ft. no-cut buffer exists to preserve the scenic environment adjacent to the trail. The Bean Cabin site is also located within the PCNST corridor. The cabin is totally collapsed but plans are being made to reconstruct it. The SMWSA is managed so as not to impair its suitability for wilderness. The developed sites around Iron Gate Reservoir are maintained and improved by PacifiCorp and are in the best

condition that their budget allows.

The analysis area is also part of the citizen's proposed Oregon High Desert Protection Act (OHDPA) of 1991. The OHDPA was submitted by a coalition of environmental groups to increase protection of selected lands. The Act proposes to expand the SMWSA from 5,867 acres to 32,000 acres.

Non-winter uses include hiking, fishing, hunting, waterskiing, camping (both dispersed and at developed sites), rock climbing, picnicking, sightseeing, mountain biking, horseback riding, driving for pleasure (both on and off roads), and mushroom and berry picking.

Winter uses include snowmobiling, snowshoeing, skiing, and sightseeing.

The future of off-highway vehicle (OHV) use of this area is currently the hottest recreational issue, with some people wanting the entire area closed to motorized use of any kind and others wanting OHV use to continue.

Cultural Resources (Archaeological and Historic Sites)

There are numerous archaeological sites within the watershed. Both the history of the Native Americans and that of the early ranchers, settlers, and hydroelectric companies are well-represented by the archaeology of this area. There were many native villages along the Klamath River (many of these sites are now inundated). The tributaries to the Klamath, such as Camp Creek, Scotch Creek, and Fall Creek, were heavily utilized for hunting and gathering. Sites representing thousands of years of resource use are known or predicted for these locations. Ridgelines and mountain meadows were also used, and sites occur and are predicted in these locations as well.

Ranching, agriculture, logging and the advent of early hydroelectric power to the area have left historic remains on the land. Known and expected historic cultural resources include ditches, dumps, fences and corrals, railroad grades, homesteads, and California-Oregon Power Company (Copco) facilities.

None of the cultural resources recorded in the project area is formally listed on the National Register of Historic Places, though there are some which are likely to be eligible. There has been systematic survey of only a portion of the watershed, mainly in parts of the California portion and along Fall Creek. Other areas, such as the ridgelines, creeks, and upland meadows in the western part of the project have not been thoroughly investigated, despite the likelihood that these areas were used in the past.

Surface collecting and off-road vehicle use pose the main threats to most of the cultural resources. Future management should consider the effects of increasing access to sensitive areas, as well as considering the direct effects of proposed projects.

Traditional Cultural Properties

Certain areas in California retain traditional use or sacred connotations to some members of the Shasta today. Sacred areas include Sentinel Peak, Coyote Peak, and some sites along Fall Creek. Traditional use areas include gathering areas along the tributaries to the Klamath River.

SPECIAL AREAS

The Bean Cabin Recreation Site is addressed under Recreation in this section, Horseshoe Ranch Wildlife Area is discussed in this section under Terrestrial Wildlife Species and Habitats and the Pokegama Wild Horse Management Area is discussed in this section under Grazing.

Pilot Rock Area of Critical Environmental Concern

The values requiring protection through the establishment of this ACEC appear to be stable. The historic, geologic, and scenic values have remained unaffected since before the ACEC designation. Wildlife values have seen slightly more disturbance due to recreational climbing in possible habitat for nesting Peregrine falcons and three species of rare bats. Botanical values have seen some deterioration of habitat for known special status plants. *Calochortus greenei*, is usually found in shrublands and open oak woodlands. These habitats have been altered by fire suppression, overgrazing, urban and rural development, and vegetation conversion for agricultural uses. The usual result of this interference is shrublands that are overmature and overly dense, and oak woodlands that are overly dense and invaded by conifers, brush and nonnative forbs.

Scotch Creek Research Natural Area

The Natural Heritage Act requires Oregon's Natural Heritage Plan to identify a discrete and limited system of natural areas that will represent the full range of Oregon's natural diversity. In order to achieve this goal, the plan uses the concept of a natural ecosystem unit comprised of one or more elements, called an ecosystem "cell." In the Klamath Mountains ecoregion, the Scotch Creek Research Natural Area fills the cell for "birchleaf mountain mohogany-ceanothus-rosaceous mixed chapparal. Actually, this area supplies two distinct chaparral communities to study: 1) chaparral dominated by rosaceous species and 2) chaparral dominated by *Ceanothus cuneatus* and *Arctostaphylos* species.

The chaparral community dominated by rosaceous species includes *Prunus subcordata, P. virginiana, P. emarginata,* and *Cercocarpus betuloides* and seems to be less impacted by fire and fire suppression. Generally, this community is stable, however, the encroachment of nonnative species, particularly yellow starthistle, could be affecting the health and development of this community.

The chaparral community dominated by *Ceanothus* and *Arctostaphylos* is a fire dependent community and has therefore been altered with years of fire suppression. This stand would tend to be overmature and overcrowded and would lack an appropriate amount of young individuals.

Cascade/Siskiyou Ecological Emphasis Area

This area is characterized by an environmental transition between the Great Basin to the east, the Cascade Mountains to the north and the Siskiyou Mountains to the south. In addition, a high elevation land bridge connecting the Cascade and Klamath Mountains transects the region. While generally regarded as a pristine landscape, this area has been affected by Euro-American management and uses. Road building, wood harvesting, recreation, fire suppression, livestock grazing, rural development have all contributed to the modification of the reference condition. The BLM is currently developing a management plan for this area that will provide for coordinated, long-term management goals. A draft plan is scheduled to be available for public comment by the spring of 2000.

EROSION PROCESSES

Natural Processes Affecting Erosion Processes and Slope Stability

Floods

The primary natural event that affects erosional processes is a flood from a rain-on-snow event, when thick snow packs in the transient snow zone are rapidly melted by warm rainstorms. These storms, especially the 1964 and 1997 events, caused natural slides to transport above normal amounts of sediment to nearby streams. During the 1955, 1964, 1974, and 1997 rain-on-snow events, soil slumping and debris flows were initiated or reactivated mainly along the steep canyon sideslopes in the upper portion of major drainages. Compared to other watersheds in southern Oregon, the Klamath-Iron Gate Watershed has held up well against the forces of intense rainstorm events. This is mainly the result of the upper portion of the watershed having limited vegetation management or roads and the lower portion having gentle topography which is not conducive to earth or debris flows.

Wildfire

Wildfire is a natural process capable of removing extensive soil cover in the Klamath-Iron Gate Watershed. There can be substantial erosion from a fire-disturbed site when an intense rainfall event occurs within a year or two after a severe fire. Once vegetative cover or litterfall is reestablished, generally within the first two years after a disturbance, soils are protected from further rainfall impact. The erosion that occurs after a wildfire can result in significant topsoil loss and stream degradation. Topsoil loss has been reduced over the past 70 years since fire suppression has resulted in fewer natural fires exposing soils. However, this situation increases the risk that an intense wildfire of long duration will occur and may cause severe soil erosion and landslide problems.

Slope Stability

Surface erosion is found where surface water is naturally concentrated in drainages/draws, or by road drainages (especially culverts) discharging water onto moderately steep to steep slopes.

Sheet, rill, and ravel erosion occur most frequently on mountainous sideslopes, and near stream channels. Surface erosion from steep, stream-adjacent slopes contributes the largest amount of sediment in the watershed. Most of the landslides and severely eroded terrain are also located on the steep slopes near streams.

Human Activities Affecting Slope Stability

The following are the major human activities that have affected erosion processes in the Klamath-Iron Gate Watershed. These activities are generally listed in order from largest impact to smallest impact potential.

Road Development

Road construction has been the largest human impact to the Klamath-Iron Gate Watershed in terms of sediment delivered to streams and negative affects to fishery habitats. Roads with inadequate drainage can result in rills, gullies, slumps, and earthflow landslides during major peak flow events (especially the 1964, 1974, and 1997 storms).

Roads can intercept water flow and concentrate the water into areas that can saturate weak soils and create conditions more likely for slope failures and surface erosion to occur. Surface water channeled down roads disrupts the natural hydrologic process and can cause some soils to be drier or wetter than what would naturally occur. This could have an effect on the type of plant communities that inhabit a site. Many of the roads in the Klamath-Iron Gate Watershed have been constructed with culverts and ditches or drain dips as the drainage structures. However, some of these roads are natural surfaced resulting in higher sedimentation to local waterways. An example of this is the Schoheim road (BLM road 41-2E-10.1). This road traverses the upper portion of the watershed and crosses most major streams in the watershed except for Fall Creek. The BLM improved drainage structures and seasonally blocked approximately 8 miles of the western portion of the Schoheim road in the fall of 1998 which leaves approximately 11 miles of the road in poor condition and continuously open for use. There are other natural surface roads in the Fall Creek drainage that are contributing above normal amounts of sediments to local waterways.

Intense rainstorms and rain-on-snow events produce heavy runoff from the roadways in these areas. As a result of the heavy runoff, roads sometimes contain rills and/or ruts on the steep grades. During intense storms, high energy runoff is often concentrated into rills on steep road grades. This concentrated water transports sediment into streams, especially at stream crossings and/or where roads parallel streams.

Timber Harvesting

Clearcut timber harvesting is second only to roads in impacting soils, streams, and fisheries, but is currently not a major concern in the Klamath-Iron Gate Watershed because the practice is no longer used on BLM-administered lands. Clearcut logging can increase the groundwater available to unstable and potentially unstable terrain, which increases the likelihood of accelerating landslide movements. This type of logging has caused some minor surface

erosion (rills and raveling) in swales and larger drainages. Most of the units with any erosion/slide features are located on or just above steeper slopes of the canyon sideslopes in the Fall Creek area. Surface erosion and landslides often start at the base or just below the clearcut units. A clearcut on the south side of Soda Mountain has contributed sediment to the East Fork of Camp Creek. Some of these areas of erosion and minor sliding have revegetated and healed naturally over time, while some may require restoration work to reduce sediment sources.

Tractor Logging

Concentrated surface runoff can cause rilling and gullying on tractor skid trails. Skid trails and non-system roads, especially in the Fall Creek drainage, resulted in several areas of surface erosion during storm events. Surface erosion features such as rills and sheet erosion are found extending down some of the skid trails.

Livestock Grazing

The impacts of poorly managed grazing to the soil resource is most apparent along streams. Concentrated grazing from cattle left without proper management can cause a decrease in vegetative ground cover and increase erosion. Soil compaction which reduces soil productivity is also a concern in areas of over use. Currently, the most apparent impact due to livestock grazing occurs in riparian areas and near watering holes as poorly managed herds congregate in these areas.

Prescribed Burning

Low intensity prescribed fires are used to remove slash following timber harvest in this watershed. Limited prescribed burning in the watershed has occurred on BLM-administered lands in the upper landscapes with most occurring in the Fall Creek area. Low intensity prescribed fires usually leave enough organic matter to keep the soils in place. However, even with low intensity prescribed fires there are often spots of high intensity fires within the burn that can adversely affect the soils and slope stability. Some sheet erosion has occurred where hot broadcast burns were followed by intense rainstorms. High intensity fires can burn off the duff layers that protect soils from erosive and gravitational forces. These fires may also cause soils to become hydrophobic (i.e., soils will not allow penetration of rainfall and snow melt), which reduces infiltration rates and increases the risk for soil erosion and topsoil loss to occur.

Prescriptions for low intensity burns can be met by burning when the weather and fuel conditions are conducive for a "cool" burn. This is usually in the late winter, early spring, and late fall of most years.

Conclusion

Roads, past clearcut timber harvest, tractor logging, livestock grazing, and prescribed burning have accelerated the rate at which sediment and debris are transported to streams. Of these human activities, roads have had the greatest effect on moving sediment into streams.

Although road densities are relatively low in this watershed, a few natural surface roads are responsible for most of the negative impacts to the streams. Thus, more sediment has been mobilized and deposited in streams in a much shorter time frame than would have occurred naturally. Relative to other watersheds in southern Oregon, the Klamath-Iron Gate Watershed has one of the lowest erosion rates.

Future Trends

The future trend for erosion and sediment production should remain at or below current levels depending on future management. Much of the watershed is designated as an ecological emphasis area and as a wilderness study area. Considering those designations, management direction for BLM-administered lands would likely be conservative and would probably promote restoration of past management areas (roads/clearcuts).

SOIL PRODUCTIVITY

Soils in the watershed have been forming for thousands to millions of years. Environmental factors such as volcanic activity, wildfires, vegetation, and climate have been the major influence on soil formation and productivity. Only in the last one hundred years have human activities had an effect on soil productivity. Forest management activities such as timber harvesting, road building and wildfire suppression have interrupted the "natural" processes of soil development. Various agricultural activities may have had an impact on the soils ability to produce vegetation and provide clean water to the streams.

Timber harvested areas have experienced a decline in soil productivity. This loss in soil productivity is directly related to an increase in soil erosion rates due to the yarding of material and the loss of vegetative cover. This is especially true for steep, mountainous sideslopes that have been clearcut and broadcast burned. The removal of organic material during logging operations that would otherwise be returned to the soil has had a negative effect on soil productivity.

Productivity losses can also be attributed to tractor logging that compacts the soil and decreases pore space used to store oxygen and water in the soil. Tractor logging has been used extensively on the flatter topography of the watershed particularly in the Fall Creek area. The amount of soil productivity lost is dependent on the amount of area compacted. Compacted skid roads usually experience a 50 percent reduction in site productivity.

On major skid trails and roads, increased compaction has resulted in some surface erosion. Soil recovery is slow and could take many decades. Recovery processes, while not well understood, probably depend on the type of vegetative succession that occurs, amount of existing site organic matter, and future disturbance regimes.

Road construction has taken land out of production in the watershed. The soil productivity loss is directly proportional to the amount of road built in the watershed. Roads also have an indirect effect on soil productivity on steep mountain sideslopes. Inadequately built roads on

unstable slopes and/or in head wall situations, often cause slope failure resulting in landslides or debris torrents.

Fire suppression activities over the last 70 years have changed the local wildfire regimes in the watershed. Wildfire frequency has decreased, however, the fire intensity has increased, resulting in the consumption of more surface duff and large woody material. High intensity wildfires also heat the soil and greatly reduce the existing soil organism populations. Although the forest usually experiences a short-term flush of nutrients from the oxidation of burned organic material, the long-term nutrient cycling is interrupted. This same phenomenon has been observed as a result of broadcast burns with high fuel loadings.

As a result of changes in logging practices on BLM-administered lands and the emphasis on watershed restoration, the trend for soil productivity in the Klamath-Iron Gate Watershed is stable and improving slightly. The potential for a catastrophic fire with high intensity is high as a result of past fire suppression which could cause soil productivity trends to reverse, particularly on southern and western aspects in the lower portion of the watershed.

PLANT SPECIES AND HABITATS

Non-Native Plant Species and Noxious Weeds

Non-native plant species can be found throughout the watershed (Appendix E) and they maintain a continuous and increasing presence on lands in the analysis area. Some species may have been intentionally introduced after major ecological disturbances to reduce erosion and hold the soil until native species can gradually re-establish. Other highly adaptive species may have been brought in to improve available forage for wildlife and livestock under past direction of public agencies and private individuals. Still others are plants which have escaped cultivation in lower elevation fields, lawns, and gardens. Finally, some non-native species have simply taken advantage of regional transportation systems to expand their range.

Any activity that creates disturbed soil and forms a corridor into an area, can act as a pathway for dispersal. Many non-natives in the watershed can be found along roadsides, quarries, areas of previous timber harvest, power and telephone line right-of-ways, and other areas of disturbance. Once established, they can rapidly spread to other areas, as many of these species possess the ability to out-compete the native vegetation, even in the absence of a disturbance.

Most non-native species can potentially out compete and displace native plants and thus alter the composition and relationships of the ecosystem. These introduced species typically have superior survival and/or reproductive techniques. They can compete with native plants for water and nutrients, frequently develop and reproduce earlier at higher rates, and often can take advantage of many more opportunities for dispersal over long distances using wind, water, animals, outdoor recreationists, and passing vehicles.

Some non-native plants which cause extreme harm to the ecosystem and/or economic interests have been designated as noxious weeds. Federal land managers cooperate with Oregon

Department of Agriculture's efforts to control and identify target species of noxious weeds by tracking their distribution on federal lands. Noxious weed populations must be located quickly to increase the effectiveness of control efforts. Integrated Weed Management (IWM) involves four general categories of management options including cultural, biological, physical, and chemical. IWM is a decision making process that uses site specific information to make decisions about treatment choices. IWM is based on the fact that combined strategies for weed management work more effectively than any single strategy. The current IWM practice method of choice for weed control is biological control. Not all noxious weeds, however, have current biological predators to control their populations and there are concerns that even under Best Management Practices, populations of noxious weeds may continue to become established and/or expand.

Special Status Plant Species and Habitats

Three species of special status plants are known to occur in the watershed (Table 14). Much of this watershed has not been surveyed for special status plants with only small areas associated with management activities being inventoried. This summer (1999), the Scotch Creek Research Natural Area is being inventoried for rare plants. Results from this survey are expected in November 1999.

Table. 14. Special Status Plants

Scientific Name	Common Name	Status[1]	No. of Populations
Calochortus greenei	Greene's mariposa lily	BSO	11 (8 in Calif.)
Fritillaria gentneri	Gentner's fritillary	FPE, SE	1
Fritillaria glauca	Siskiyou fritillary	BAO	1

1/ Status

BSO = Bureau Sensitive in Oregon
FPE = Federal Proposed Endangered
SE = State Endangered in Oregon
BAO = Bureau Assessment in Oregon

Habitat requirements for these plants are quite specific. The required habitat type for *Calochortus greenei* and *Fritillaria gentneri* is rather common in the watershed but rare for *Fritillaria glauca*.

Fritillaria gentneri is a candidate for addition to the List of Endangered and Threatened Wildlife and Plants under the Endangered Species Act of 1973. This species is usually found in dry, open fir and oak woodlands, shrublands and savannahs. This particular habitat type is common in the watershed, however, only one population of this species is known. Presently, an estimate of between 66-83 percent (27,958-35,159 acres) of the watershed could provide suitable habitat for this species. These habitat types have declined with Euro-American manipulation, both in area and in condition. *Fritillaria gentneri* is found only in the rural foothills of Jackson and Josephine Counties.

Calochortus greenei is a BLM Sensitive species in Oregon and California. This plant was also a category-2 candidate for listing under the Endangered Species Act of 1973 until 1996 when the Fish and Wildlife Service discontinued the maintenance of a category-2 list. *Calochortus greenei* is usually found in shrublands and open oak woodlands. These habitat types account for 66 percent (27,958 acres) of the watershed area but only 11 populations are known. These habitat types have declined with Euro-American manipulation, both in area and in condition. *Calochortus greenei* is known only from a small area around the Oregon-California border.

Fritillaria glauca is a BLM Assessment species in Oregon. The Oregon Natural Heritage Program considers this plant imperiled because of rarity or factors making it vulnerable to extirpation in the state but apparently secure globally. This plant has a very narrow habitat requirement, being found exclusively on talus slopes and serpentine. There are small inclusions of suitable habitat for this species principally on the west side of the watershed and along the major ridges. Some of this habitat type has been lost due to road building and rock source development. *Fritillaria glauca* is found only in Oregon and California.

Survey and Manage Plant Species and Habitats

Three species of Survey and Manage fungi are known to occur in the watershed (Table 15). A general inventory on nonvascular plants was conducted in this area in 1998 and 1999.

Table 15. Survey and Manage Plant Species and Habitats

Species	Survey Strategy[1]	Habitat Requirement	Number of Sites
Gyromitra montana	3, 4	Coniferous forest, snow zone	1
Pithya vulgaris	1, 3	Coniferous forest, usually *Abies*	1
Sarcosoma mexicana	3, PB	Coniferous forest	2

1/ Survey strategies are from the Northwest Forest Plan (USDA and USDI 1994a) and are listed in the Characterization section.

All three of these species are found in coniferous forests. Suitable habitat for these species is available in only 15 percent (6,354 acres) of the watershed. Older coniferous forests have been reduced and the condition of the remaining forests declining from the reference condition.

Gyromitra montana is an uncommon cup fungus. This species prefers older forests and is generally found fruiting within weeks of snow melt. This fungus is considered more common in eastern North America than the west.

Pithya vulgaris, a rare cup fungus and component 1 species, has specific management recommendations that protect known sites and habitats. Previously known from only eight sites in Oregon, however, within the last year numerous sites have been documented in our area. Globally, this species is widespread in boreal forests of the North Temperate Zone.

Sarcosoma mexicana, an uncommon cup fungus and a Protection Buffer (PB) species, has general mitigating measures and data gathering requirements. This species is usually found in closed canopy conifer forests and is known only from western North America and Mexico.

FOREST DENSITY AND VIGOR

Vegetation disturbance mechanisms (abiotic and biotic) that influence the watershed's forest stand structure are logging, fire and fire suppression, bark beetles, pathogens, and dwarf mistletoe species associated with Douglas-fir and true fir species. In most cases, the biotic factors are influencing the forest structure in response to the low vigor of the forest stands and are therefore secondary. The primary concern with the predominantly mid and mature seral stage vegetation is the overstocked condition which causes low vigor and/or poor growth. Low vigor occurs when diameter growth falls below 1.5 inches over 10 years and results in trees that are more susceptible to bark beetle attack (Hall 1995).

The forest matrix of the northwest portion of the watershed is predominantly Douglas-fir and white fir or incense cedar. Sugar pine and ponderosa pine are scattered throughout. The forest stands are overstocked and diameter growth is decreasing. The forest stands are uneven-aged and as a result have numerous canopy layers. Douglas-fir dwarf mistletoe (*Arceuthobium douglasii)* is present as well as red ring rot (*Fomes pini*). Frost could be a major problem for reforestation at the higher elevations.

The forest matrix of the northeastern portion of the watershed is predominantly Douglas-fir and ponderosa pine. Some incense cedar and white fir are present. These forest stands tend to be more even-aged with only one canopy layer. Frost and animal damage can be major problems for reforestation.

South of the forest matrix areas the vegetation shifts rapidly to woodlands, shrublands, and grasslands because of soils and aspect changes. The southern most portion of the watershed is composed of juniper, shrubs, and grasses.

Nelson (1997) notes that there is a great amount of overlap and intermingling of vegetation in the area and grouped the vegetation in six broad categories: wet, mixed conifer; dry mixed evergreen; oak woodlands; brushy chaparral; rocky juniper steppe; and riparian.

Vegetation Disturbance Mechanisms

Biotic processes that are influencing the forest stand dynamics and structure in the watershed include: dwarf mistletoe, bark beetles, and to a small extent forest pathogens. These biotic processes can cause tree and possibly stand mortality, shifting the forest stands to the understory reinitiation stage; the stage in which the tree canopy layer opens and allows regeneration to become established in the understory.

Douglas-fir dwarf mistletoe (*Arceuthobium douglasii*) is present in places. Mistletoe species and pathogens can reduce tree vigor which enables bark beetles to invade the stressed trees.

Infected true fir trees are susceptible to attack by the fir engraver beetle (*Scolytus ventalis*). Pathogens that could be in the watershed include: laminated root rot (*Phellinus weirii*), annosus root rot (*Fomes annosus*), brown cubical butt rot (*Phaeolus schweinitzii*), red ring rot (*Phellinus pini*), and Indian paint fungus (*Echinodontium tinctorium*). Windborne spores can infect new hosts through tiny dead branch stubs or tree stumps and remain dormant until the tree is stressed, usually by wounding. All of these processes create unhealthy trees that become safety hazards when located near houses, recreation areas, or roadways.

Coarse Woody Material

Coarse woody material (CWM) appears to be the heart of numerous ecosystem processes and is a vital part of forest productivity. Perry (1991) lists various functions of CWM and how it affects forest productivity. Tree roots with their mycorrhizal hyphae transport nutrients into decaying logs. Nitrogen-fixing bacteria contained in decaying logs increases the nitrogen over time. Nitrogen-fixation within logs adds approximately 1.2 pounds per acre of nitrogen annually on a per unit weight basis, approximately two to five times more than in mineral soil. If measured as plant available rather than total, logs contain from 10 to 30 percent of the available nitrogen (N) and phosphorus (P). In old-growth forests, approximately four percent of the total ecosystem N and P are contained in CWM.

Older, decayed logs serve as water reservoirs and because of their water content, become centers of biological activity during the summer months. One process that may take place is nitrogen-fixation by free-living bacteria. During the summer, logs have more water and are better buffered against temperature extremes. Almost all woody plants form a root symbiosis with certain fungi. It is hypothesized that CWM facilitates the reinoculation of clearcuts with truffle-forming mycorrhizal fungi. *Rhizopogon vinicolor* is especially important in gathering water. Microbes and invertebrates directly affect primary productivity through affects on nutrient cycling.

Maintaining the maximum levels of CWM consistent with reasonable fuel loadings appears to have considerable potential for enhancing site quality. Mid-seral stands with no CWM may have yields 12 percent lower than stands with sufficient CWM. As a crude estimate, primary production may be increased by a few percent for each ten tons of CWM left on site. CWM also stores carbon, which probably mitigates the "greenhouse effect".

CWM appears to be sufficient (approximately 13 to 20 tons/acre; 130 to 285 feet of 16-foot logs) in the northwest forest matrix area due to natural processes and the present stand age and forest stand structure. Most stands are uneven-aged and are in the understory reinitiation stage of stand development, the stage at which biotic and abiotic processes begin to cause tree mortality. The historic stands had significantly fewer trees per acre, thus CWM was probably found in lesser quantities.

Forest Productivity

Forest productivity is generally defined in terms of site quality, which is a measure of tree growth over a given period of time. Site quality is determined by the physical characteristics of the soil, steepness of slope, aspect, microclimate, and species present. An indirect method of measuring site quality is to determine the site index of the soil. Site index is simply the height a tree will grow in a given time period. The Soil Survey of Jackson County Area, Oregon (1993) uses a reference age of 50 years for Douglas-fir. The soil survey indicates most of the soil series in the watershed are capable of growing Douglas-fir trees to a height of 70 to 90 feet in 50 years. The best soil (Tatouche series) will grow trees 90 feet in height in 50 years; the poorest soils (Farva, Hobit, McMullin, and McNull series) have a site index of 70 feet. These site potentials may not be met in the present-day overstocked forest stands.

For the majority of the mid and mature seral Douglas-fir stands in the watershed, the average relative density index is approximately 0.70 (the ratio of the actual stand density to the maximum stand density attainable in a stand with the same mean tree volume) (Drew and Flewelling 1979). A relative density index of 0.55 is considered to be the point of imminent competition/mortality; and at this point, trees have a greater probability of dying from biotic factors, mainly bark beetles.

Trends

Throughout the analysis area, the overstocked pole through mature size seral stage forests have a low level of growth or vigor and are susceptible to bark beetle attack and pathogens. If forest stands are not thinned precommercially and/or commercially, tree mortality is expected to continue at increased rates. This is especially true for clumps of young pine, or old-growth pines surrounded by dense Douglas-fir regeneration. Dense forest stands with ladder fuels are prone to intense forest fires. If fires occur, more shrubs and grasses can be expected to grow.

Shifts in tree and shrub species can be expected to continue without thinning treatments. Shrubs may die beneath dense tree overstories. Early seral, shade intolerant species will continue to decline unless large openings (1 acre or more) are created. If mortality occurs in large patches, the early seral species will probably regenerate.

Without thinning treatments the vegetation disturbance mechanisms previously discussed will become more evident. Bark beetles could kill large acreages of trees, and old-growth pine if populations are allowed to grow. Patches of root rot infected trees will also enlarge.

FIRE AND AIR QUALITY

Over the past century, fire suppression has effectively eliminated five fire cycles in southwestern Oregon mixed conifer forests that occur at low elevations (Thomas and Agee 1986). The historic fire cycle was 20 years or less in this region. The absence of fire has converted open savannas and grasslands to woodlands and initiated the recruitment of conifers. Oregon white oak is now a declining species largely due to fire suppression and replacement by Douglas-fir on most sites.

The absence of fire due to suppression efforts has changed the make-up of the local forests to fire-intolerant, shade-tolerant conifers and has decreased species such as ponderosa pine and sugar pine. This conversion from pine to true fir has created stands that are stressed, which increases their susceptibility to accelerated insect and disease problems (Williams et al. 1980).

Horizontal and vertical structure of local forests has also changed. Surface fuels and the laddering effect of fuels have increased, resulting in the escalated threat of crown fires which were historically rare (Lotan et al. 1981). This trend is leading the forests from a low-severity fire regime to a high-severity regime, characterized by infrequent, high intensity, stand replacement fires. Fire is now an agent of ecosystem instability as it creates major shifts in forest structure and function. This trend continues throughout southwestern Oregon, as well as most of the western United States.

Fire suppression efforts over the past decades have altered, to some degree, how fires burn within areas classified under the low-severity regime. Typically, fires now burn more acres with high severity stand replacement fires. This is due to higher tree densities and increased ground fuels within timbered stands. Impacts of suppression efforts are difficult to quantify within this regime due to the varying degree of how fires normally burn within this regime.

Fire risk is defined as the chance of various ignition sources causing a fire that threatens valuable resources, property, and life. Historic lightning occurrence indicates there is the potential of lightning fires starting throughout all elevations within the watershed. The highest fire risk areas are major ridge lines due to lightning strikes and lands adjacent to roads and private property because of the potential for human-caused fires.

Some of the higher values at risk within this watershed are private residential and agricultural property, water quality, forest resources (such as northern spotted owl core areas, mature/old growth stands, and plantations), recreation sites, historic sites, and research natural areas. Table 16 summarizes these values at risk within the watershed.

Table 16. Values at Risk Due to Fire Exclusion, High Intensity Wildfire, or Wildfire Suppression Activities

Resource	Values at Risk
Recreation/Social	Aesthetic: visual, spacial, and spiritual.
Habitat	Threatened and endangered species, and thermal cover.
Improvements	Private homes, power transmission lines, Soda and Parker Mountain fire lookouts, Soda Mountain communications installations, farming and ranching facilities, managed timber lands.
Historic Sites	Historic sites with wood, such as cabins, flumes, corrals, etc., or other burnable materials.
Archeological Sites	Numerous sites (vulnerable to suppression activities).
Soils/Geology	Increased surface erosion, loss of litter layer, decrease in site productivity, change in soil structure, slope stability, and accelerated landslide activity.
Economic	Suppression costs and loss of products (recreation, timber, special products, livestock, range, and rural development).
Botanical	Numerous sites (vulnerable to suppression activities). All areas are susceptible to encroachment by non-native species in the event of high intensity fire. Suppression activities such as fireline construction, placement of camp sites, and vehicle use can impact all botanical habitat; moist mountain meadows are particularly sensitive.
Safety	Firefighters, public, visibility, telephone and power lines.
Air Quality	Public health and visual quality.

Fire hazard is the threat of fire ignition, spread, and difficulty of control which is determined through assessment of vegetation by type, arrangement, volume, condition, and location. Hazard ratings were developed for the Oregon portion of the watershed using vegetation (type, density, and vertical structure), aspect, elevation, and slope. Due to time constraints, imagery classification and hazard rating development for the California portion of the watershed were not completed, however, the percentages are anticipated to be much the same as the ratings for Oregon. Map 16 displays the fire hazard rating distribution within the Oregon portion of the watershed and Table 17 summarizes the percent of the Oregon portion of the watershed within each hazard rating.

Table 17. Fire Hazard Ratings[1]

Hazard Rating	Percent
Low	1
Medium	59
High	40

1/ Ratings only developed for the Oregon portion of the watershed.

In general, the existing fuel profile in the lower elevations within the Klamath-Iron Gate Watershed represents a moderate to high resistance to control under average climatic conditions. Most of the timber stands have a dense overstory and a moderate amount of ground fuel and ladder fuels are present. This creates optimal conditions for the occurrence of crown fires which could result in large stand replacement fires. This type of fire also presents an extreme safety hazard to suppression crews and the public.

Air Quality

Levels of smoke or air pollutants have only been measured over the past three to four decades. The Clean Air Act directed the State of Oregon to meet the national ambient air quality standards by 1994. The Oregon Smoke Management Plan identifies strategies to minimize the impacts of smoke from prescribed burning on smoke sensitive areas within western Oregon. Particulate matter the size of 10 microns (PM10) or less is the specific pollutant addressed in this strategy. The goal of the Oregon Smoke Management Plan is to reduce particulate matter emissions from prescribed burning by 50 percent by the year 2000 for all of western Oregon. Particulate matter has been reduced by 42 percent since the baseline period (1991).

Currently, the population centers of Grants Pass and Medford/Ashland are in violation of the national ambient air quality standards for PM10 and are classified as non-attainment areas for this pollutant. The non-attainment status of these areas is not attributable to prescribed burning. Major sources of particulate matter within the Medford/Ashland area are smoke from woodstoves (63 percent), dust, and industrial sources (18 percent). Prescribed burning contributes less than 4 percent of the annual total.

Emissions from wildfires are significantly higher than from prescribed burning. The wildfires that occurred in southern Oregon in 1987 emitted as much particulate matter as all other burning that occurred within the state that year. Prescribed burning under spring-like conditions consumes less of the larger fuels creating fewer emissions. Smoke dispersal is easier to achieve due to the general weather conditions that occur during the spring. The use of aerial ignition reduces the total emissions by accelerating the ignition period and reducing the total combustion process due to the reduction of the smoldering stage.

The visual effect of smoke produced from prescribed burning could reduce visibility within a project area or could concentrate the smoke around a project site or surrounding drainages. Prescribed burning would comply with the guidelines established by the Oregon Smoke Management Plan and the Visibility Protection Plan.

TERRESTRIAL WILDLIFE SPECIES AND HABITATS

Wildlife-General

The Klamath-Iron Gate Watershed is home to approximately 260 terrestrial vertebrate wildlife species. Nelson (1997) documented the presence of 138 species in the Soda Mountain Wilderness Study Area (SMWSA), and speculated that another 81 species were likely present

based on the known range of the species and the presence of suitable habitat in the SMWSA. Also, approximately 40 additional species are associated with Iron Gate Reservoir. There are also untold numbers of terrestrial invertebrate species present; however, little is known about these species due to the dearth of systematic inventories.

The following plant communities and associated stand conditions as described by Brown (1985) provide habitat for the terrestrial vertebrate wildlife species found in the Klamath-Iron Gate Watershed: grass-forb dry hillside, mountain shrubland and chaparral, deciduous hardwood, mixed coniferous forest, and high temperate coniferous forest. Iron Gate Reservoir, a commanding feature of the watershed, also provides habitat for approximately 40 species as described above. Table 18 lists species that are representative of the non-coniferous plant communities and the various condition classes/seral stages of the coniferous plant communities

Table 18. Representative Wildlife Species

Condition Class	Representative Species
Grass-forb dry hillside	Gopher snake, western meadowlark, California ground squirrel
Mountain shrubland and chaparral	Western fence lizard, wrentit, dusky-footed woodrat
Deciduous hardwood forest	Ringneck snake, acorn woodpecker, western gray squirrel
Conifer Condition Classes	
Seedling/sapling	Northwestern garter snake, mountain quail, pocket gopher
Pole (5-11" DBH)	Southern alligator lizard, golden-crowned kinglet, porcupine
Large pole (11-21" DBH)	Ensatina, Steller's jay, cougar
Mature/old-growth (21+" DBH)	Northern spotted owl, northern flying squirrel

Habitat conditions vary rather dramatically in the watershed. The northeastern (Fall Creek) portion of the watershed contains intermingled BLM-managed and privately-owned land. This area is primarily conifer dominated, and has been intensively harvested by both BLM and the private landowners. Due to the type of harvest, much of the area is functionally in the early condition classes (seedling/sapling).

The northwest portion of the watershed, however, is managed primarily by BLM, and generally only the few parcels of private land in this area have been intensively harvested. Many of the conifer stands on BLM-managed land in this area, particularly those on the more mesic sites (e.g., in drainages), have mature/old-growth characteristics, e.g., a high degree of canopy closure, and adequate snags and down woody material. There are also intermingled mountain meadows which add to diversity in this area.

Fire suppression has played a significant role in the structure and functioning of all habitat in the watershed, but may be most pronounced in the mountain shrubland and deciduous hardwood plant communities. Most regeneration of mountain shrubland habitat is dependent

on fire, and in its absence the trend has been toward senescence with little regeneration. The result is a lack of early and mid seral habitat in this plant community. Encroachment of shrubs and introduced grasses and forbs into the oak-savannah has changed the structure of this habitat considerably.

Much of the native grass-forb dry hillside habitat has been replaced by introduced noxious weed species, e.g., yellow starthistle, and by encroaching mountain shrubland communities. The extent of the loss of native grasses and forbs due to the spread of yellow starthistle in the foothill areas north of Iron Gate Reservoir is dramatic. Iron Gate Reservoir and agricultural pursuits have also contributed to the loss of native grassland.

Although supportive data are unavailable, the apparent general decline in habitat condition probably has not resulted in a significant decrease in the variety of wildlife species present in the watershed. There has undoubtedly, though, been substantial change in species abundance and distribution. Several species have been extirpated from the watershed, e.g., grizzly bear and gray wolf, but their demise was more directly human-caused rather than from the habitat change described above.

Threatened/Endangered Species

The northern spotted owl and bald eagle, both federally listed threatened species, are present in the watershed. Four spotted owl nest sites/activity centers have been found and 3 are currently active. It is assumed the fourth site is inactive due to timber harvest. The site was routinely active from 1980 until a timber harvest in 1987/88 removed much of the suitable habitat in the home range, and the pair has not been found since. There are no known bald eagle nest sites in the watershed, but they are known to forage around Iron Gate Reservoir.

There are approximately 2,010 acres of suitable northern spotted owl habitat on BLM-managed land within the analysis area. Some suitable habitat might occur on private lands, but it would be a small and rather insignificant amount. Suitable habitat provides nesting, roosting or foraging functions for spotted owls, and generally has the following attributes: high degree of canopy closure (approximately 60 percent or more), multilayered canopy, and presence of large snags and coarse woody material.

Northern Spotted Owl Critical Habitat and Dispersal Conditions

Approximately 7,025 acres of the watershed are in northern spotted owl critical habitat unit (CHU) OR-38 (Map 17). The U.S. Fish and Wildlife Service (USFWS) designates critical habitat to preserve options for recovery of the species by identifying existing habitat and highlighting areas where management should be given high priority (USDI 1992). In the case of the northern spotted owl, critical habitat was designated to protect clusters of reproductively-capable owls and to facilitate demographic and genetic interchange (USDI 1992). A primary reason for designating CHU OR-38 was to facilitate linkage between the Western Cascades and the Klamath Mountains physiographic provinces (USDI 1994a). CHU OR-38 is in the South Ashland I-5 area of concern where linkage between physiographic provinces is felt to be at risk due to past management practices (USDI 1992). There are

approximately 1,760 acres of suitable spotted owl habitat in that portion of the CHU in the watershed.

Critical habitat was designated prior to implementation of the Northwest Forest Plan (NFP). The NFP established a network of Late-Successional Reserves (LSR) to protect and enhance conditions of late-successional ecosystems which serve as habitat for late-successional related species such as the northern spotted owl (USDA and USDI 1994a). In the biological opinion for the NFP, the USFWS acknowledged that the NFP is similar in function to critical habitat, particularly since there is considerable overlap between the CHUs and LSRs, and that the NFP would enable critical habitat to perform the biological function for which it was designated (USDI 1994b). There is general agreement between the action and regulatory agencies that the role of critical habitat located outside of the LSR network is to contribute to dispersal/connectivity between LSRs. Except for designated spotted owl core areas, all of the CHU in the watershed is in the matrix land allocation as described in the NFP; thus, the primary function of critical habitat in the watershed is to contribute to adequate dispersal conditions for spotted owls.

Disperal

In looking at the dispersal picture for the watershed, there are approximately 3,660 acres of dispersal habitat present on BLM-managed lands: 2,010 acres of suitable habitat and 1,650 acres of dispersal-only habitat. Most of the dispersal habitat is in the northern portions of Slide Creek, Scotch Creek, Dutch Oven Creek, and Camp Creek drainages where conifer forests are predominant and there is a high percentage of BLM-managed land. Portions of this area are also in CHU OR-38. In the Fall Creek portion of the watershed there is a limited amount of BLM-managed land, and there is also a limited amount of dispersal habitat. As explained previously, this area has been extensively harvested by BLM and private owners. This portion of the watershed is not in CHU OR-38.

Due to the current situation in the Fall Creek drainage, and a paucity of conifer forest in the southern portion of the Jenny Creek Watershed, which is adjacent to the analysis area, dispersal habitat in a band along the Oregon-California border is limited.

Special Status Species

Special status species include those species that are listed by the U.S. Fish and Wildlife Service as threatened or endangered, proposed for listing as threatened or endangered, candidates for listing as threatened or endangered, or are listed by the BLM as sensitive or assessment species.

Twenty-one special status species are known or suspected (based on known range and availability of suitable habitat) to be present in the Klamath-Iron Gate Watershed. Table 19 lists the species, status, and primary reason(s) for listing as special status species.

Table 19. Special Status Terrestrial Vertebrate Wildlife Species

Species	Status[1]	Primary Reason(s) for Status
Foothill Yellow-legged Frog (*Rana boylii*)	BS	Declining population
Western Pond Turtle (*Clemmys marmorata*)	BS	Habitat loss/degradation, predation
Sagebrush Lizard (*Sceloporus graciosus*)	BS	Restricted range
California Mountain Kingsnake (*Lampropeltis zonata*)	BA	Demand by collectors. Spotty distribution
Common Kingsnake (*Lampropeltis getulus*)	BA	General rarity. Demand by collectors. Spotty distribution.
Sharptail Snake (*Conti tenuis*)	BA	Spotty distribution, habitat loss
Northern Spotted Owl (*Strix occidentalis caurina*)	T	Loss of habitat
Northern Goshawk (*Accipiter gentilis*)	BS	Loss of habitat
Great Gray Owl (*Strix nebulosa*)	BS/PB	Loss of nesting/roosting habitat
Northern Saw-whet Owl (*Aegolius acadicus*)	BA	Loss of habitat
Pileated Woodpecker (*Dryocopus pileatus*)	BA	Loss of habitat
Lewis' Woodpecker (*Asyndesmus lewis*)	BA	Fire suppression, salvage logging following fires
White-headed Woodpecker (*Picoides albolarvatus*)	BA	Loss of habitat through timber harvest and fire suppression
Western Meadowlark (*Sturnella neglecta*)	BA	Urbanization
Western Bluebird (*Sialia mexicana*)	BA	Urbanization, salvage logging, competition for nests
Townsend's Big-eared Bat (*Plecotus townsendii*)	BS	Limited suitable habitat, declining populations, susceptibility to human disturbance.
Fringed Myotis (*Myotis thysanodes*)	BS	General rarity, susceptibility to human disturbance
Long-eared Myotis (*Myotis evotis*)	BS	Roosting/hibernacula habitat loss, susceptibility to human disturbance.
Yuma Myotis (*Myotis yumanensis*)	BS	Lack of information, susceptibility to human disturbance

Species	Status[1]	Primary Reason(s) for Status
Long-legged Myotis (*Myotis volans*)	BS	Roosting/hibernacula habitat loss, susceptibility to human disturbance.
Pacific Pallid Bat (*Antrozous pallidus*)	BS	General rarity, lack of information

1/ Status:
- T - Listed as threatened under the Endangered Species Act (ESA)
- BS - Bureau sensitive
- BA - Bureau assessment
- PB - Protection Buffer

Survey and Manage Species, Protection Buffer Species, and Bat Roost Sites

Seven species known or suspected to be present in the analysis area are afforded extra protection in the Northwest Forest Plan under Standards and Guidelines for Survey and Manage Species (S&M), Protection Buffer Species (PB), and Bat Roost Sites. These species are: Great gray owl (PB); Townsend's big-eared bat, fringed myotis, silver-haired bat, long-legged myotis, long-eared myotis, and pallid bat (Bat Roost Sites). The watershed is within the range of six S&M mollusc species, but so little is known about these species it is difficult to speculate whether or not they are present. All of the species addressed above are associated to some degree with late-successional forests.

The NFP requires surveys using developed protocol for S&M and PB species where there will be ground-disturbing activities within the known or suspected range of the species and suitable habitat is present. Surveys have not been conducted in the analysis area because no ground-disturbing activities have been proposed since implementation of the NFP.

Black-Tailed Deer

Black-tailed deer in the watershed are part of the Jenny Creek Interstate Deer Herd. Some portions of the summer range for this herd are in the higher elevations of the watershed, and a substantial part of the winter range for the herd is in the lower elevations of the watershed. In the Oregon portion of the watershed, the Jenny Creek Deer Winter Range (7,430 acres) is identified for special management with a focus on improving forage and cover conditions and decreasing the density of roads that are open to vehicular traffic. In the California portion of the watershed, the Horseshoe Ranch (6,325 acres) is managed primarily for wintering deer by the California Department of Fish and Game and BLM, Redding Field Office. The management focus in this area is to improve forage conditions (browse in particular), limit vehicular access, ensure proper grazing levels, and provide adequate water sources (McClain 1983). Map 18 shows the deer winter range.

High quality winter forage is important in the maintenance of healthy productive herds since this period is generally the most demanding in terms of physiological stress, e.g., maintaining body temperature. Winter forage, however, is in poor condition in the analysis area. Introduced noxious herbaceous species, such as yellow starthistle and medusahead rye, which do not provide quality forage, have displaced native grasses and forbs which generally provide

high quality forage. Also, browse species such as wedgeleaf ceanothus have become decadent, and are not providing the quality forage that younger plants provide.

Hiding cover is important to deer because it provides escapement from predators and disturbances caused by other mechanisms, such as off-highway vehicles (OHVs) and other vehicular use of open roads. Paradoxically, fire suppression which has negatively affected forage conditions, has generally improved hiding cover conditions in the analysis area. In the absence of fire, shrubs and trees that provide hiding cover have become more dense.

Thermal cover can be important on both summer and winter ranges because it moderates thermal extremes which in turn reduces the energy expended by deer to maintain body temperature. Thermal cover is generally provided by conifers and other evergreen trees, although deciduous hardwoods can provide summer thermal cover. Forest stands providing thermal cover are generally greater than 40 feet in height and have canopy closure values in excess of 60 percent (Brown 1985). Summer thermal cover has been reduced in those high elevation areas where timber harvest has occurred. Winter range thermal cover in the watershed is limited by natural vegetative conditions. The predominant winter range plant communities are grassland, shrubland and deciduous hardwoods. There are only scattered patches of conifer forest with enough canopy closure to provide thermal cover.

Trends

Spring trend counts conducted by the Oregon Department of Fish and Wildlife (ODFW) indicate that since the early 1990s there has been a general decline in the deer population. The Oregon portion of the watershed is in the Rogue Big Game Unit, and buck/doe ratios for this unit are 35 percent below management objectives (Wolfer 1999). The reason(s) for this decline are not clear, but one factor may be late season hunts that take place when deer are on the winter range (Wolfer 1999).

HYDROLOGY

For purposes of the hydrology discussion, the Klamath-Iron Gate Watershed is stratified into four subwatersheds: Scotch, Camp, and Fall Creeks and Iron Gate (Map 9).

Groundwater

Baseline information to assess the current status of groundwater quantity or quality is not available.

Streamflow

Peak Flow

Maximum peak flows in the tributaries generally occur from December through March (based on historical records from unregulated U.S. Geological Survey gaging stations adjacent to the

watershed) and from November to May in the Klamath River below Iron Gate Dam (based on USGS streamflow records). These high flows are often a result of rain-on-snow storm events that occur when a substantial amount of rain falls on snow accumulated in the transient snow zone (elevation zone of 3,500 to 5,000 feet). The combination of rain moving into the stream channels and rapid snowmelt can result in flooding. A recent example of flooding that resulted from a rain-on-snow event in the southwest Oregon region occurred January 1, 1997. The transient snow zone occupies 17,029 acres (40 percent) of the watershed (51 percent of Scotch Creek Subwatershed, 40 percent of Camp Creek Subwatershed, 61 percent of Fall Creek Subwatershed, and less than one percent of Iron Gate Subwatershed).

Upland disturbances, both natural and human-caused, can result in increased magnitude and frequency of peak flows. Increases in size and frequency of peak flows may result in accelerated streambank erosion, scouring and deposition of stream beds, and increased sediment transport. The natural disturbance having the greatest potential to increase the size and frequency of peak flows is a severe, extensive wildfire. Loss of large areas of vegetation due to a wildfire would likely have an adverse effect on the watershed's hydrologic response. In the Klamath-Iron Gate Watershed, the primary human disturbances that can potentially affect the timing and magnitude of peak flows include dams, roads, soil compaction (due to land development, logging, agriculture, and grazing), and vegetation removal (due to timber harvest and conversion of sites to agriculture use). Quantification of these effects on streamflow in the watershed is unknown.

The dams on the Klamath River have dramatically altered the Klamath River flow regime within the watershed. No pre-dam flow data exists, however based on similar situations in the Rogue Basin, it is likely that high flows have been moderated, resulting in fewer and smaller peak flows.

Roads quickly transport shallow subsurface flow intercepted by roadcuts and water from the road surface to nearby streams (Wemple 1994). The road-altered hydrologic network may increase the magnitude of peak flows and alter the timing when runoff enters a stream. This effect is more pronounced in areas with high road densities and where roads are in close proximity to streams. Map 4 gives a visual portrayal of road densities for all ownerships and Map 19 shows sections with road densities greater than 4.0 miles/square mile. These sections with high road densities are listed in Appendix F. Road and stream crossing information is shown in Table 20 for subwatersheds in the watershed. Sections with road/stream intersections greater than 10 per square mile are included in Appendix F. Fall Creek Subwatershed has a greater road density and a higher stream crossing density (8.6 per square mile) than the other subwatersheds in the Klamath-Iron Gate Watershed.

Table 20. Road Information by Subwatershed

Subwatershed	Total Road Miles[1]	BLM Roads[2] (percent)	Road Density (miles per sq. mile)	Stream Crossings (number)	Road Surface Type (miles)			
					Natural	Rock	Bitum.	Unknown
Fall Creek	53.3	29	3.5	132	7.4	13.8	1.3	30.8
Camp Creek	28.6	64	1.5	77	16.0	5.2	0.2	7.2
Scotch Creek	19.2	72	1.1	67	18.2	0.0	0.3	0.7
Iron Gate	28.7	4	2.2	54	1.2	0.1	7.9	19.5
Watershed Totals	129.8	38	2.0	330	42.8	19.1	9.7	58.2

1/ Roads shown on the GIS transportation theme.
2/ Roads with BLM control or on BLM-administered land.

Soil compaction resulting from roads, yarding corridors, agriculture, and concentrated livestock grazing also affects the hydrologic efficiency within a watershed by reducing the infiltration rate and causing more rainfall to quickly become surface runoff instead of moving slowly through the soil to stream channels (Brown 1983). Soil compaction data has not been compiled for the Klamath-Iron Gate Watershed.

Vegetation removal reduces interception and transpiration and allows more precipitation to reach the soil surface and drain into streams or become groundwater. Until the new vegetation obtains the same crown closure as the previous unmanaged stand, it is considered to be hydrologically unrecovered. Douglas-fir and white fir stands are considered to be 100 percent hydrologically recovered when they obtain 70 percent crown closure. Pine stands reach 100 percent hydrologic recovery when the crown closure is 30 to 50 percent; 30 to 40 percent would be for south and west aspects, while north aspects would be at 40 to 50 percent.

The estimated percent hydrologic recovery by subwatershed is shown in Table 21. This data was calculated by applying recovery factors to the vegetation information derived from Landsat imagery for the 1997 Klamath Bioregional Assessment Project (see Landscape Vegetation Pattern section). Areas classified as water, rock, and grassland/shrubland are considered fully recovered for this analysis. Recovery factors for hardwood and forested areas are based on full hydrologic recovery occurring when a forest stand reaches 75 percent crown closure. Forest stands with 40 percent crown closure are considered to be 50 percent recovered and forest stands with a crown closure of 5 percent or less are treated as 0 percent recovered. Crown closure information is not available for the analysis area, therefore conservative estimates were made for hydrologic recovery by vegetation class based on crown closure information from adjacent watersheds.

Large areas of vegetation removal in the transient snow zone are of particular concern due to alterations of the streamflow regime and resultant increased peak flow magnitudes (Christner and Harr 1982). The estimated percent of hydrologic recovery in the transient snow zone is shown in Table 21.

Table 21. Estimated Percent of Hydrologic Recovery by Subwatershed

Subwatershed	Estimated Percent of Area Hydrologically Recovered	
	All Lands	Transient Snow Zone
Scotch Creek	78	75
Camp Creek	75	71
Fall Creek	78	77
Iron Gate	90	72
Total	80	75

Low Flow

Summer streamflows in the Klamath-Iron Gate Watershed reflect the low summer rainfall (Figure 1, Characterization section) and sustained high evapotranspiration. The lower reaches of Scotch and Camp Creeks are often dry by mid-to-late summer. The greatest need for water occurs during the summer when demand for irrigation and recreation use is highest.

Map 20 displays diversion point locations associated with places of use for the Oregon portion of the watershed. Table 22 provides water right information obtained from the Oregon Water Resources Department (OWRD 1999) and the California State Water Resources Control Board, Division of Water Rights (Snyder 1999).

Table 22. Surface Water Rights

Subwatershed	Water Use (cfs)					
	Irrigation	Municipal	Domestic	Power	Fish Culture	Total
Scotch Creek	4.00					4.00
Camp Creek			0.01			0.01
Fall Creek	1.55	15.0		10.0		26.55
Iron Gate				3,300	48.0	3,348.0
Totals	5.55	15.0	0.01	3,310.0	48.0	3,378.56

The municipal water rights are held by the City of Yreka and the hydroelectric power and fish culture rights are held by PacifiCorp.

There are reservoir rights for 3.5 acre-feet in Scotch Creek, 0.18 acre-feet in Camp Creek, and 0.30 acre-feet in Fall Creek that are used for livestock.

The Klamath River below Copco Dam is diverted into a penstock for approximately 0.25 mile before it is returned to the river channel.

The Oregon Water Resources Department (WRD) is currently conducting an Oregon general stream adjudication in the Klamath River Basin. Adjudication is the Oregon statutory process for quantification and documentation of all rights to water, the use of which was initiated before February 24, 1909, and federal reserved water rights, including the rights of Indian tribes and their members. The Klamath Adjudication is the first Oregon general stream adjudication in which complex federal claims have been filed. The BLM has filed claims for federal reserved water rights for springs in the analysis area. The WRD initiated a voluntary dispute resolution process in 1997 to provide a forum to address adjudication claim issues and other matters related to water supply and demand in the Klamath River Basin. The WRD completed the claim review in August 1999 and is currently conducting an open inspection of claims.

Trends

The flow regime in the watershed is not expected to noticeably change in the future. Peak flows will likely continue to result from major storm events that include rapid melting of snow in the transient snow zone. Low summer flows will be exacerbated during years of below normal precipitation. No significant increase in water development is anticipated in the watershed.

STREAM CHANNEL

Physical stream surveys were completed on the lower 5.5 miles of Camp Creek and 5.64 miles of Fall Creek by the BLM in August 1975 (King et al. 1977). Additional surveys were completed by the Oregon Department of Fish and Wildlife (ODFW) on Lower Camp Creek and East Fork (also known as Right Fork) Camp Creek in 1997 (ODFW 1997). The ODFW survey crew was denied access to the lower reach of Camp Creek so their data points begin at the mouth of Salt Creek, about two miles upstream from Iron Gate Reservoir. No survey data is available for Scotch Creek, therefore descriptions of its stream system are based on aerial photos and field observations by BLM personnel.

The Level I Rosgen stream channel morphology classification system (Rosgen 1996) was used to classify streams in the watershed and the results are shown on Map 12. A variety of channel morphologies exist, ranging from Rosgen type Aa+ to type G. Appendix C provides descriptions of Rosgen morphological stream types. Table 10 (Characterization section) provides the mileage by channel type for streams in the watershed.

Scotch Creek

The Scotch Creek drainage, including its primary tributary Slide Creek, covers approximately 11,503 acres. Stream gradient is low to moderate from Iron Gate Reservoir to the Oregon border, but steepens beyond that point. The channel meanders through a narrow valley near the confluence with Slide Creek, then it is confined in a narrow V-shaped valley with steep hillslopes to its headwaters.

Camp Creek

Camp Creek and its major tributaries, Dutch Oven and Salt Creeks, comprise the largest subwatershed with a total of 12,579 acres. Physical stream survey data collected by ODFW (1997) and by BLM (King et al. 1977) provide a description of Camp Creek and East Fork Camp Creek. The ODFW survey of Camp Creek from the mouth of Salt Creek to the confluence with East Fork Camp Creek at mile 4.5 characterizes this reach as having a low to moderate gradient that averages 0 to 2.5 percent. Most of the surveyed area has a gradient varying from 0.5 to 1 percent. Near the end of the surveyed portion the gradient increases to 4 percent. Appendix G, Figure G-1 is a graph showing changes in stream gradient from the mouth to mile 4.5 (7,437 meters). The elevation for this section starts at 950 meters and rises to 1,000 meters. The BLM survey noted that upper stream reaches have gradients in excess of 7 percent. Much of the Camp Creek channel is entrenched with low terraces within a V-shaped valley with steep hillslopes. Rapids predominate the stream surface area. Pools are shallow, averaging about 0.5 meters. There are no pools with the desired 1+ meter depth. Pool/riffle ratio is displayed in Appendix G, Figure G-2.

The substrate has very little silt and organics. Sand and cobble predominate, with more bedrock showing above the Oregon border. Appendix G, Figure G-3, is a graph showing percentages of substrate composition from the mouth to East Fork Camp Creek. Three bedrock falls occur within the first three miles, and create impasses to upstream migration of fish (King et al. 1977). Substrate material above East Fork Camp Creek is a mixture of fines and cobble over bedrock. The amount of woody debris in Camp Creek is low with an average of only five pieces per 100 meters of stream channel. Appendix G, Figure G-4 is a graph depicting number of pieces and wood volume (coarse woody debris) in lower Camp Creek.

The ODFW survey of East Fork Camp Creek noted that over 50 percent of the bank area showed active erosion, some of it because of cattle activity. A high degree of bank erosion was also noted by King along Camp Creek above mile 3.5. This report attributed the disturbances to cattle. Off-highway vehicle (OHV) use in the watershed is responsible for some upslope erosion and subsequent siltation in the subwatershed.

A gravel road follows along Camp Creek to about mile 2.0. Houses and small ranches are scattered along the stream from the mouth of Dutch Oven Creek to a short distance above Salt Creek. Influences on the stream from rural development includes water withdrawal, sediment from road runoff, removal of riparian vegetation, and streambank trampling by cattle.

Fall Creek

Fall Creek is the longest of the three subwatersheds, but it is a narrow drainage encompassing only 9,877 acres. The first 0.75 mile of stream has a moderate gradient, good shade and a good pool/riffle relationship. Just above this point is a 50 foot waterfall that is an impasse to upstream migrating fish. Above the falls the gradient is steep, then a second falls appears near mile 1.25. The steep stream gradient continues to mile 3.00 then the slope flattens and meanders through a flat valley where the Fall Creek and Hopkins Ranches are located. The Spring Creek diversion canal enters Fall Creek near mile 4.00 adding high quality water to the

system. Substrate material in this upper portion of Fall Creek consists mostly of fines and small gravel. Stream banks are fairly stable, and the stream has a good supply of coarse woody material. Small headwater streams increase in gradient near the northeast side of the drainage. Substrate material in these upper areas is rock. There are two high points in this subwatershed; Grizzly Mountain at 5,112 feet and Parker Mountain at 5,206 feet.

Fall Creek differs from the other subwatersheds in that its flow is manipulated. Water from Spring Creek, a spring-fed tributary to Jenny Creek, is diverted to Fall Creek which in turn is diverted into a canal and penstock near mile 3.00. The penstock drops the water 730 feet over a basalt bluff to a hydroelectric plant operated by PacifiCorp. This facility is located at mile 0.75. Below the plant the water is diverted a second time into a pump and pipeline that transports the water to the City of Yreka, 23 miles away (King et al. 1977).

Trends

The trend for stream channel condition on BLM land should improve over the long term as conifers and hardwoods in riparian areas increase in size and have greater potential to provide shade and ample quantities of downed woody debris. An increase in instream woody debris will capture flood-born material, create meander, and improve other aspects of stream morphology such as pool/riffle relationship, and hiding cover and spawning gravels for native fish. As sources of sediment and causes of bank disturbance are better identified and corrected there will be less sediment released into streams and disturbed streambanks will become more stable and vegetated.

WATER QUALITY

Section 303(d) of the Clean Water Act requires each state to identify streams, rivers, and lakes that do not meet water quality standards even after the implementation of technology-based controls. These waters are referred to as "water quality limited" and states are required to submit 303(d) lists to the U.S. Environmental Protection Agency every two years. The Oregon Department of Environmental Quality's (DEQ) 1998 303(d) list does not include any streams within the Oregon portion of the Klamath-Iron Gate Watershed (ODEQ 1999). The California Environmental Protection Agency's 1998 303(d) list includes the Klamath River from the Oregon border to Iron Gate Dam (Table 23).

Table 23. Water Quality Limited Streams

Stream Name	Description	Parameter
Klamath River	Oregon border to Iron Gate Dam	Nutrients, dissolved oxygen, and temperature

Source: California Environmental Protection Agency 1998

The DEQ's 1988 Oregon Statewide Assessment of Nonpoint Sources of Water Pollution does not identify any stream segments in the Oregon portion of the Klamath-Iron Gate Watershed that are impacted by nonpoint source pollution.

Water quality parameters critical to the most sensitive beneficial uses (Characterization section, Water Quality) in the Klamath-Iron Gate Watershed are: flow modifications, temperature, dissolved oxygen, pH, nutrients, bacteria/pathogens, turbidity, sedimentation and habitat modifications. Flow and habitat modifications are discussed in Hydrology and Aquatic Wildlife, respectively. The processes and disturbances affecting the other critical water quality parameters and current conditions are described below.

Temperature

Elevated stream temperatures can stress aquatic life. Natural processes that can affect stream temperature are high air temperatures, below normal precipitation and subsequent low flows, and wildfires and floods that result in the loss of riparian vegetation. Human disturbances affecting stream temperatures include water withdrawals, channel alterations that increase width/depth ratio, and riparian vegetation removal through logging, grazing, or residential clearing.

Water quality criteria for temperature are established by the states to protect resident fish and aquatic life, and salmonid fish spawning and rearing. The Oregon temperature standard for summer temperatures in the Klamath Basin was revised in January 1996. The standard now states that the seven day moving average of the daily maximum shall not exceed 64°F (ODEQ 1998). The California temperature standard for cold interstate waters like the Klamath River prohibits the temperature alteration of the natural receiving water unless it can be demonstrated to the satisfaction of the Regional Water Board that such alteration does not adversely affect beneficial use. At no time or place shall the temperature of any cold water be increased by more than 5°F above the natural receiving water temperature (California Regional Water Quality Control Board (CRWQCB) 1997).

The section of the Klamath River within the watershed is on California's 303(d) list for temperature. Sources of the high temperatures have been attributed to dam construction/operation, flow regulation/modification, water diversions, habitat modification, and nonpoint sources. California has assigned a medium priority for developing total maximum daily loads for temperature on the mainstem of the Klamath River.

Summer stream temperatures have been measured in Dutch Oven Creek, Camp Creek, and East Fork Camp Creek. Monitoring results are shown in Table 24. Stream temperatures measured in Dutch Oven Creek have been below the Oregon standards each of the four years monitored. The 1997 seven day average maximum temperatures measured at Camp and East Fork Camp Creeks were less than the state standard. However, the 1998 seven day average maximum temperatures at Camp and East Fork Camp Creeks exceeded the temperature standard and further monitoring is needed to determine if these streams should be added to the water quality limited stream list. The higher stream temperatures in 1998 are possibly due to higher air temperatures than in 1997.

Table 24. Stream Temperature Monitoring Data

Site Location	1995		1996		1997		1998	
	7 Day Ave. Max. (°F)	No. Days 7 Day Max >64°F	7 Day Ave. Max. (°F)	No. Days 7 Day Max >64°F	7 Day Ave. Max. (°F)	No. Days 7 Day Max >64°F	7 Day Ave. Max. (°F)	No. Days 7 Day Max >64°F
Dutch Oven Creek above Camp Creek	61.1	0	63.8	0	55.1	0	61.3	0
Camp Creek, East Fork	—	—	—	—	57.8	0	64.3	2
Camp Creek, above East Fork	—	—	—	—	63.1	0	65.5	24

Source: BLM (1995, 1996, 1997, and 1998)

Dissolved Oxygen

Dissolved oxygen concentration refers to the amount of oxygen dissolved in water. Dissolved oxygen is critical to the biological community in the stream and to the breakdown of organic material (MacDonald et al. 1991). Dissolved oxygen concentrations are primarily related to water temperature; when water temperatures increase, oxygen concentrations decrease. (MacDonald et al. 1991).

Oregon's dissolved oxygen standard was revised in January 1996. The new standard describes the minimum amount of dissolved oxygen required for different water bodies (i.e., waters that support salmonid spawning until fry emergence from the gravels, waters providing cold water aquatic resources, waters providing cool-water aquatic resources, etc.) (ODEQ 1998). California's dissolved oxygen standard for the Klamath River between Iron Gate Dam and the state line is a 50 percent lower limit of 10.0 mg/l which means that 50 percent or more of the monthly means must be greater than or equal to 10.0 mg/l. Other streams within the watershed have a 50 percent lower limit of 9.0 mg/l. The minimum value allowed by California for dissolved oxygen in the Klamath River and tributaries is 7.0 mg/l (CRWQCB 1997).

The section of the Klamath River within the Klamath-Iron Gate Watershed is on California's 303(d) list for dissolved oxygen. Sources of the low dissolved oxygen levels have been attributed to municipal point sources, agricultural return flows, and flow regulation/modification. California has assigned a medium priority for developing total maximum daily loads for the mainstem of the Klamath River.

Dissolved oxygen data is not available for the tributaries to the Iron Gate Reservoir.

pH

pH is defined as the logarithmic concentration of hydrogen ions in water in moles per liter. pH can have direct and indirect effects on stream water chemistry and the biota of aquatic ecosystems. pH varies inversely with water temperature and shows a weak inverse relationship to discharge. Forest management activities can indirectly increase pH through the introduction of large amounts of organic debris and by increasing light to streams (MacDonald et al. 1991).

State water quality criterion for pH in the Oregon portion of the Klamath Basin ranges from 6.5 to 9.0 (when 25 percent of the measurements taken between June and September are greater than pH 8.7, the DEQ shall determine whether the measurements higher than 8.7 are anthropogenic or natural in origin) (ODEQ 1998). California's pH criterion for the Klamath River and tributaries within the watershed ranges from 7.0 to 8.5 (CRWQCB 1997).

No pH data is available for the watershed.

Nutrients

Nitrogen and phosphorus nutrients are important in aquatic systems because they stimulate primary production (e.g., bacteria and algae) and possibly secondary production (e.g., macroinvertebrates and fish). However, accumulations of nitrogen and phosphorus, particularly in lakes, may stimulate algal growth to the point where eutrophication begins and the beneficial uses such as recreation and fishing are impaired (MacDonald et al. 1991).

Nutrient total maximum daily loads (TMDLs) are being developed for the Oregon portion of the Klamath River (ODEQ 1998). California has not established any water quality objectives for nutrients.

The Klamath River from Iron Gate Dam to the Oregon border is on California's 303(d) list for nutrients. Sources of the high nutrient levels have been attributed to municipal point sources, irrigated crop production, agricultural return flows, and nonpoint sources. California has assigned a medium priority for developing total maximum daily loads for the mainstem of the Klamath River.

No nutrient data is available for the Klamath River tributaries within the analysis area.

Bacteria/Pathogens

Waterborne pathogens include bacteria, viruses, protozoa, and other microbes that can cause skin and respiratory ailments, gastroenteritis, and other illnesses. Most drinking and recreational waters are routinely tested for certain bacteria that have been correlated with human health risk. If the average concentration of these bacteria falls below the designated standard, it is assumed that the water is safe for that use and that there are no other pathogenic bacteria that represent a significant hazard to human health (MacDonald et al. 1991). The four groups of bacteria most commonly monitored are total coliforms, fecal coliforms, fecal

streptococci, and enterococci. Fecal coliform bacteria are mostly those coliform bacteria that are present in the gut and feces of warm-blooded animals. They can be directly linked to sanitary water quality and human health risks.

Oregon's water quality criterion for bacteria states that for a 30-day log mean of 126 *Escherichia coli* (a species of fecal coliform) organisms per 100 ml, based on a minimum of five samples, no single sample shall exceed 406 *E. coli* organisms per 100 ml (ODEQ 1998). California's bacteria criterion states that the bacteriological quality shall not be degraded beyond natural background levels. In waters designated for contact recreation, the median fecal coliform concentration based on a minimum of not less than five samples for any 30-day period shall not exceed 50/100 ml, nor shall more than ten percent of total samples during any 30-day period exceed 400/100 ml (CRWQCB 1997). The purpose of the bacterial water quality standard is to protect the most sensitive designated beneficial use, which has been identified as water contact recreation.

No bacteria/pathogen data is available for the Klamath River or tributaries within the analysis area.

Sediment and Turbidity

Sedimentation is the natural process of sediment entering a stream channel. However, an excess of fine sediments (sand-size and smaller) can cause problems such as turbidity (the presence of suspended solids) or embeddedness (buried gravels and cobbles). Sedimentation is generally associated with storm runoff and is highest during fall and winter. Natural processes occurring in the watershed such as surface erosion, mass wasting, wildfire, and flood events contribute to increased sedimentation.

Oregon's standard for sedimentation states that "the formation of appreciable bottom or sludge deposits or the formation of any organic or inorganic deposits deleterious to fish or other aquatic life or injurious to public health, reaction, or industry shall not be allowed" (ODEQ 1998). Oregon's standard for turbidity states that "no more than ten percent cumulative increase in natural stream turbidities shall be allowed, as measured relative to a control point immediately upstream of the turbidity causing activities" (ODEQ 1998). The California water quality objective for sediment states that "the suspended sediment load and suspended sediment discharge rate of surface waters shall not be altered in such a manner as to cause nuisance or adversely affect beneficial uses" (CRWQCB 1997). California's turbidity objective states that "turbidity shall not be increased more than 20 percent above naturally occurring background levels" (CRWQCB 1997).

Accelerated rates of upland erosion in the watershed are primarily caused by road building and logging (see Erosion Processes). Older roads with poor locations, inadequate drainage control and maintenance, and no surfacing are more likely to erode and cause the sedimentation of stream habitats. The Schoheim road is a natural surfaced road that crosses the upper portion of Scotch Creek and Camp Creek Subwatersheds. Although approximately eight miles of this road had drainage improvements in the fall of 1998, there are still approximately 11 miles that are in poor condition and contributing sediment to stream channels. The erosion problems on

Schoheim road are due to inadequate drainage and maintenance that is exacerbated by OHV use (Salix Applied Earthcare 1998). There are also natural surfaced roads that are contributing sediment to streams in the Fall Creek Subwatershed.

Unmanaged livestock grazing in riparian zones, residential clearing of riparian zones, irrigation ditch blowouts, and poor irrigation practices all may contribute to sedimentation. Streambank erosion is accelerated by riparian vegetation removal. Bank erosion due to cattle activity has been noted in the East Fork Camp Creek (see Stream Channel section). Cattle impacts to a spring adjacent to Scotch Creek have also been observed (Menanno 1999).

During stream surveys in 1997, Oregon Department of Fish and Wildlife (ODFW) measured a high percentage of fine sediment (20.4 percent) in lower Camp Creek from the confluence with Salt Creek upstream to the Schoheim road crossing (ODFW 1997). A high percentage of this reach was observed to have actively eroding stream banks. A high percentage of fine sediment (25 percent) was also measured in the upstream reach that extends to East Fork Camp Creek. However, stream banks in this reach were observed to be vegetatively stabilized.

The ODFW 1997 stream survey also covered East Fork Camp Creek from the confluence with lower Camp Creek to T.40 S., R. 5 W., Section 34, SW quarter. This reach was observed to have a high percentage of fines (25 percent) with a high percentage (52.6) of the reach noted as having actively eroding stream banks.

No winter season turbidity data is available for streams within the Klamath-Iron Gate Watershed.

Water Quality Trends

The water temperature trend in the Klamath River is likely to remain unchanged due to dam operations, flow regulations, water withdrawals, high width/depth ratio, and lack of riparian cover. Water temperatures in the Klamath River tributaries may show some improvement in the long term as the Northwest Forest Plan is implemented on federal lands and riparian vegetation recovers along the tributary streams. However, high summer air temperatures and the southerly flow direction of the tributaries may not permit water temperatures to consistently stay below 64°F even with riparian canopy intact. Additional stream temperature monitoring will help determine whether or not the temperatures result from natural conditions.

The dissolved oxygen, pH, nutrients, and bacteria levels are not expected to change in the future within the watershed. Sedimentation and turbidity in the watershed will probably stay at the existing level or could possibly decrease if road drainage is improved, natural surfaced roads are surfaced, and roads contributing sediment are decommissioned. Proper management of livestock grazing would also help reduce the amount of sediment delivered to streams.

RIPARIAN AREAS

Riparian vegetation at lower elevations in Camp and Scotch Creeks is confined to narrow corridors on either side of the perennial streams, especially in areas characterized by narrow V-shaped valleys and steep hillslopes. Tree and shrub growth in these corridors is fairly thick and provides good shading. The 1997 ODFW stream survey noted that Lower Camp Creek is well shaded with an average of about 60 percent coverage. Appendix G, Figure G-5 is a graph showing the percent of open sky (measured every 200 meters) throughout the surveyed portion. Hardwoods make up most of the overstory. Dominant species are alder, white oak, black oak, big-leaf maple, Oregon ash, willow and some black cottonwood. Ponderosa pine, Douglas fir and western juniper are present, but scattered. Understory vegetation is most commonly Oregon grape, snowberry, and ceanothus. Also present is skunkbrush (*Rhus trilobata)* and mock orange.

Riparian vegetation in the Camp Creek and Scotch Creek Subwatersheds transforms to other species as elevation increases. Douglas-fir, intermixed with ponderosa and sugar pine, becomes common near the Oregon border. Mock orange is a more common understory species. Further up the slope these plant communities give way to expanses of roseaceous chaparral. At the highest elevation, headwater drainages are encompassed in fairly continuous coniferous forest dominated by white fir.

The lower reaches of Fall Creek have similar riparian vegetation as found in Camp Creek and Scotch Creek Subwatersheds, however, riparian vegetation near the Fall Creek Ranch becomes a mixed conifer-hardwood plant community. Sugar pine is a common tree throughout this area. Headwater reaches on the slopes of Parker and Grizzly Mountains flow through uninterrupted stands of conifers.

Trends

Implementation of Aquatic Conservation Strategy Objectives and establishment of Riparian Reserves on federal lands will result in protected and improved riparian habitat over the long period. The use of silvicultural treatment within riparian stands could improve the health, vigor, and diversity of these areas. Stream shading will improve and the potential for use by wildlife will increase.

AQUATIC WILDLIFE SPECIES AND HABITATS

Resident Fish

Both the ODFW and BLM stream survey reports for Camp and East Fork Camp Creeks include numerous sightings of trout throughout the surveyed portions. The BLM account (King et al. 1977) identified the fish as rainbow (*Oncorhynchus mykiss*) and established the upper limit of fish use at a waterfall just above mile 5.00. The ODFW survey report (1997) stated that fish observations were common and seen throughout the surveyed reaches. One trout was positively identified as a cutthroat trout (*Onchorhynchus clarki*). Whether both

species co-exist in the Camp Creek system is questionable. The frequency of fish observations during the ODFW survey is provided in Appendix G, Figure G-6. George Wright (1954), who wrote numerous antidotal stories about when he was a young boy and young man in the Klamath country, mentions good populations of "mountain trout" in the Camp Creek system.

Very little was known of resident fish populations in Scotch and Slide Creeks prior to 1999, when BLM fisheries biologists undertook presence and absence surveys in an effort to fill this data gap. Resident rainbow trout were observed in Scotch Creek from the mouth upstream to a rock barrier a short distance above the Oregon/California border in T 41S, R 3E, SW 1/4 section 8. Rainbow trout were also found to be plentiful in Slide Creek from its confluence with Scotch Creek upstream to the Oregon/California border.

King (1977) states that the Fall Creek system supports a healthy population of native rainbow trout throughout its distance. He also states that it is reasonable to believe that Iron Gate Reservoir trout use the lower reach of Fall Creek to spawn in the spring. This possibility was substantiated in June 1992 when BLM and California State fisheries biologists electrofished this lower portion and collected several large rainbow trout, 10+ inches, and one German brown trout (*Oncorhynchus trutta*). Hatchery produced rainbow have been released into the reservoir. Their different genetic makeup may have affected the genetic integrity of native trout below barriers. This may also be the case for rainbow trout in lower Scotch and Camp Creeks.

It is likely that redband trout, native to Jenny and Spring Creeks, have infiltrated the Fall Creek stream system via the Spring Creek diversion canal. The reverse is also possible with Fall Creek trout entering the Jenny Creek system. To what extent this may have occurred is unknown, and the ramifications for genetic integrity of trout stocks in either watershed is unclear.

The Klamath smallscale sucker (*Catostomus rimiculus*) migrates into tributaries of the Klamath River to spawn. Suckers that reside in Iron Gate Reservoir move into Scotch, Camp and Fall Creeks in spring months for this purpose. King (1977) noted that juvenile suckers exceeded 50 per 100 feet in slower waters within a few yards of the mouth.

Marbled sculpin (*Cottus klamathensis*) is a another common stream dwelling fish in the Klamath River Basin. Hohler (1981) collected this fish in lower Jenny Creek while doing research on the Jenny Creek sucker. It is reasonable to assume this fish resides in streams in this analysis area as well.

Hohler also found fathead minnow (*Pimephales promelas)* below a waterfall on the lower reach of Jenny Creek while doing his research. It is possible that this introduced fish also resides in the lower reaches of Scotch, Camp and Fall Creeks.

Anadromous Fish

When Copco Dam was completed on Klamath River in 1911, it was decided not to build a fishway to pass anadromous fish upstream. Instead, a fish hatchery was constructed on the

lower end of Fall Creek to mitigate for loss of upstream spawning. It was turned over to the California Department of Fish and Game for operation. Fall chinook salmon, *Onchorhynchus tshawytscha*, and steelhead, *Onchorhynchus mykiss*, were trapped and artificially spawned. Their eggs were hatched at the Fall Creek Hatchery and the young fish were later released back into the system. Following the completion of Iron Gate Dam in 1962, another hatchery was constructed at the mouth of Bogus Creek below the dam to mitigate for the loss of spawning for both dams. This hatchery is also operated by the California Department of Fish and Game. This facility is used in conjunction with the Fall Creek Hatchery to annually produce five million chinook fry, one million chinook yearlings, 200,000 steelhead yearlings and 75,000 coho (*Onchorhynchus kisutch)* yearlings. Coho in the Klamath Ecoregion are listed as a threatened species by the National Marine Fisheries Service (NMFS).

Chinook and steelhead historically migrated well upstream of Iron Gate and Copco Dams, but it is uncertain how far upstream coho moved. Brood fish were initially captured at a trap located at Klamathon downstream of Iron Gate Dam. Steelhead moved into a number of small tributaries in winter months to spawn. Wright (1954) indicated that these fish used Camp Creek upstream to the first falls, and stated that Rocky Gulch, a lower tributary on Camp Creek is (was) "a good little stream for steelhead fish in the winter when there is enough water." King (1977) suspected that chinook spawned in lower Camp Creek also.

Before the construction of Iron Gate Dam, salmon and steelhead moved up Fall Creek. It is assumed these fish were returning to the Fall Creek Hatchery (Maria 1999), and may not have been an indication of historical use of this stream by these fish.

Lake Fish

Iron Gate Reservoir has a variety of fresh water and warm water game fish as well as several non-game fish species. Table 25 is a list of the species present (Maria 1999).

Table 25. Fish of Iron Gate Reservoir

Game Fish		Non-game Fish	
Common Name	Scientific Name	Common Name	Scientific Name
Rainbow trout	*Oncorhynchus mykiss*	Lost River sucker	*Catostomus macrocheilus*
German brown trout	*Oncorhynchus trutta*	Shortnose sucker	*Chasmistes brevirostris*
Largemouth bass	*Micropterus salmoides*	Klamath smallscale sucker	*Catostomus rimiculas*
White crappie	*Pomoxis annularis*	Klamath largescale sucker	*Catostomus snyderi*
Black crappie	*Pomoxis nigromaculatus*	Klamath speckled dace	*Rhinichthys osculus*
Pumpkinseed sunfish	*Lepomis gibbosus*	Klamath tui chub	*Gila bicolor*
Yellow perch	*Perca flavescens*	Blue chub	*Gila coerulia*
Brown bullhead	*Ictalurus punctatus*	Pacific lamprey	*Lampetra tridentata*

Game Fish		Non-game Fish	
Common Name	Scientific Name	Common Name	Scientific Name
		Marbled sculpin	*Cottus klamathensis*

None of the game fish in Iron Gate Reservoir can be considered native. Rainbow trout are of hatchery origin and do not share the genetic makeup of native fish.

Fathead minnow reportedly resides in lower Jenny Creek (Hohler 1981), however Maria (1999) did not find it in Iron Gate Reservoir while conducting population studies. Fathead minnow is an introduced species.

Channel catfish (*Ictalurus punctatus*) is established in Copco Reservoir, but has not yet been detected in Iron Gate Reservoir (Maria 1999).

Macroinvertebrates

In 1993, Robert Wisseman conducted macroinvertebrate sampling in Dutch Oven Creek in the Camp Creek Subwatershed. This work was done as part of BLM's overall aquatic monitoring program. In general, aquatic insects are excellent indicators of stream "health" because specific species are tolerant or intolerant of particular stream conditions, like fine sediments, warm water, woody debris, etc. Wisseman found that Dutch Oven Creek has a high aquatic insect diversity. Many of the species are indicative of cold water and cobble habitat that is not embedded by fine sediments (Wisseman 1993). King (1977) referring to Camp Creek wrote that "aquatic insect life, including representatives of the Orders: Plecoptera, Tricoptera and Ephemeroptera, were noted in abundance."

Interestingly, the species that Wisseman found in Dutch Oven Creek are not typical for medium-elevation streams in a xeric (dry) area. Dutch Oven Creek in particular supports an invertebrate fauna more typical of moist, maritime and mid-higher elevation western Cascade streams (Wisseman 1993). Wisseman believes that these insects are a relict community left over from the last glaciation. "If so", Wisseman states, "there is a high probability that some of these insects may be candidates for special status."

Although no thorough mollusk surveys have been completed for the entire analysis area, Wisseman's 1993 macroinvertebrate survey in Dutch Oven Creek found snails of the Hydrobiidae family that may be endemic to these streams (Wisseman 1993). Terry Frest conducted fairly extensive sampling for aquatic mollusks in the Jenny Creek Watershed and some in the Fall Creek drainage in 1991. He found several different species of snails of the Hydrobiidae family. In the Jenny Creek-Fall Creek area, according to Frest, "4 to 6 or even 7 taxa may co-occur at certain sites, a sympatric diversity that is seldom equaled elsewhere in the world outside of ancient lake endemic swarms" (Frest 1998). One species, *Fluminicola* n. sp. 8, he named Fall Creek pebblesnail. This is one of the taxa found in both Jenny and Fall Creeks. It occurs in large, cold, pristine springs and their outflows, and is common on gravel-cobble substrates associated with dense stands of water cress, *Rorippa*. Another pebblesnail, *Fluminicola* n. sp. 9, dubbed lunate pebblesnail, was discovered in Jenny Creek and Spring

Creek, and is presumably one of those also found in Fall Creek. Another aquatic mollusk, *Juga (Calibasis) acutifilosa* (scalloped juga) is established in Fall Creek below the Spring Creek diversion. This juga is very rare and is known from only this location in Oregon. It is found intermixed with a more common species of juga in Fall Creek. These snails are members of the Family Pleuroceridae.

Klamath crayfish, *Pacifastacus liniusculus klamathensis*, is a common inhabitant of Jenny Creek and the Klamath River system. It is most likely well established in Iron Gate Reservoir, but there is no evidence from stream surveys or other recorded observations that it resides in Fall or Camp Creeks.

Amphibians

No formal surveys of amphibians have been conducted in the watershed, so little is known about species and abundance. It is assumed that Pacific giant salamander, *Dicamptodon tenebrosus*, is in the perennial portions of streams. This species is abundant in Shoat Springs above the Spring Creek diversion into Fall Creek. Rough skinned newt, *Taricha granulosa*, is found in small excavated ponds near Bean Cabin in the headwaters of Camp Creek.

Habitat

The BLM survey of Camp Creek (King et al. 1977) noted that stream flow "is low in late summer (approximately 1 cfs at the mouth on 8/5/75); however water temperature is not prohibitive for salmonid habitat (61 degrees F at the mouth at 10:00 a.m. on 8/4/75)." Good shade cover helps to maintain this cool water, however, ODFW (1997) indicated portions of lower Camp Creek were dry during their August/September survey. Deep pools, suitable for juvenile rearing habitat, are lacking, but gravel of suitable size for spawning is available. Three possible fish barriers were noted by both surveys. One is near mile 1.25, one near mile 2.00, and the third one at mile 2.75. Trout were observed between the barriers and above the last one to mile 5.5. Stream conditions are apparently very good for aquatic insects.

Fall Creek below the Spring Creek diversion has a good flow of cold water and is very suitable for a variety of aquatic organisms, including trout, salamanders and mollusks. The exception is the portion of stream below the PacifiCorp diversion to the penstock and the powerhouse. This section is reduced to about 1 cfs. Fall Creek upstream of the Spring Creek diversion experiences low flows in summer months. There is no flow data for this portion of stream.

Aquatic Wildlife Species and Habitats Trends

On BLM-administered land, populations of fish, other aquatic organisms, and riparian dependent wildlife, and their habitats should show continued improvement in most stream segments in the analysis area. Improvements in watershed conditions should moderate streamflow and temperature, create more shading, produce greater stream channel complexity, and reduce introduction of sediment. These improvements are expected to increase potential for production of fish and other aquatic organisms and for birds, mammals and herptiles using riparian habitat.

Generally, no changes are anticipated for aquatic resources in Iron Gate Reservoir, however, additional exotic species, such as channel catfish, may be introduced into the lake.

REFERENCE CONDITIONS

The purpose of the reference conditions section is to explain how ecological conditions have changed over time as a result of human influences and natural disturbances. This section provides a reference for comparison with current conditions.

HUMAN USES

Introduction

This brief environmental history traces the major interactions of past human inhabitants with the land, and suggests some effects of these interactions upon the land. Historic information is always incomplete, often anecdotal, and rarely quantifiable. Yet the story presented here provides some glimpses into the past, and something of a roadmap to the conditions we now face as we enter a new century.

Prior to describing this history, a very brief review of the climate history of the last 10,000 years is presented as part of the long story of the environment of the Klamath-Iron Gate Watershed.

Paleoclimates

A recent analysis of a pollen core from Bluff Lake in California provides a record of long-term climate change in this region for over 10,000 years (Mohr 1997). Bluff Lake is located about 40 miles south of the Klamath-Iron Gate Watershed (near Mt. Shasta) at an elevation of about 6300 feet, in Township 40 South, Range 6 West, Section 9, Mt. Diablo Meridian. A long core was taken from the lake and pollen counts from the core were used to reconstruct the surrounding vegetation. Past vegetation patterns were then used to infer past climates. The study yielded the following sequence.

> 13,500 BP (Before Present): cooler and wetter than present; relatively closed pine and fir forest.
>
> 10,000 - 7,500 BP: warm, dry conditions prevail; fir and subalpine taxa disappear, open forests of oak and juniper appear, and mid-elevation conifers become established, along with a montane chaparral-type shrub understory; fire becomes an important element in maintaining xerophytic ("dry-loving") vegetation.
>
> 7,000 BP: slightly cooler, though conditions remain warmer and drier than at present.
>
> After 4,000 BP: the climate becomes increasingly cooler and wetter; fir and pine become more abundant and oak declines; fire intervals become less frequent.

2,000 BP: forests of modern composition become established after 2,000 years ago; fire frequencies increase slightly, possibly due to burning by native peoples.

Native Inhabitants and the Land

Archaeological evidence indicates that people have inhabited the region for about 10,000 years. During the first several thousand years of human occupation, until about 7,000 years ago, human populations were very low and very mobile. People lived in small bands, and hunted and gathered throughout the landscape.

After about 7,000 years ago populations began to increase, and regular camps appear in the archaeological record for the watershed. For the next 5,000 years, people living in this region followed a remarkably stable pattern of existence, though towards the end of this period changes began to take place. During this time, native peoples lived in small bands, moving themselves seasonally about the countryside in search of valued resources, in increasingly well-defined group territories. Hunting was important, as was gathering root and seed crops. The first known camps appeared in the Klamath Canyon about 6,500 years ago, and archaeological sites dating throughout this period attest to the use of the Klamath-Iron Gate Watershed during this time. By the end of this period, however, significant changes appear in the archaeological record, signifying changes in the native way of life (Mack 1991).

This new way of life was well established after 2,000 years ago. It was characterized by larger populations, well-defined group territories, and a higher degree of sedentism than existed previously. Permanent villages, inhabited for at least part of the year, appear in the archaeological record. These villages were usually situated at lower elevations near major rivers and streams, reflecting a stronger emphasis on fish resources. Group interactions also intensified, evident in an increase in trade and warfare. Social hierarchies developed, with wealth items representing higher status among individuals or families. This way of life continued until the coming of Euro-Americans to this region.

The native people known as the Shasta were living in numerous villages along the Klamath Canyon at the time of contact with Euro-Americans in the nineteenth century (Theodoratus 1984, Gray 1993). The Shasta, as well as the Klamath and Modoc tribes, used the uplands above the Klamath River for a variety of resources, and there are numerous archaeological sites in the watershed reflecting this use (Medford District and Redding Field Office archaeological site and survey files).

These native peoples had developed a highly sophisticated understanding of the environment in which they lived and the resources on which they depended. As hunters/gatherers/fishers, they interacted with the environment to promote and enhance those foods and materials of most benefit to them. Roots and bulbs, such as camas and various forms of *perideridia* (e.g. ipos) provided starchy staples. Fish, especially anadromous fish such as salmon, and major ungulates (deer, elk) provided essential protein. Acorns from oak trees were another nutritious food. In addition, a wide variety of berries, nuts, seeds (e.g. tarweed seeds), fowl, and other game augmented the diet. Other plants and animals were used for a wide variety of necessary materials, for basketry, fiber, tools, clothing, and medicines.

Native peoples throughout the region employed a number of techniques to manage their environment. Their most important tool was fire. Fire was probably used for thousands of years, but became a major tool for resource management during the last two thousand years, coinciding with expanding human populations and the advent of a cooler and wetter climate.

Fire was used for a variety of purposes (LaLande and Pullen 1999). Fire was used in hunting to drive game animals to the kill, and for the longer-term goal of improving and maintaining wildlife habitat. Open, park-like forests were also a goal, because they made hunting easier. Fire assisted in promoting and maintaining staple crops, such as acorns from oak trees. Fire maintained open meadows and prairies, both in the uplands and valleys, which were crucial locations for subsistence resources including game, roots, bulbs, berry patches, and grass seeds.

Native peoples used fire for specific purposes and carefully regulated its use. Burning took place at certain times (mainly spring and fall) and at specific intervals, and contributed to the development of the prairies and savannahs of the valleys, oak and oak/pine woodlands of the foothills, and the meadows of the uplands.

Archaeological and historic evidence documents a substantial native presence in permanent villages along the Klamath Canyon and the lower elevation tributaries of the Klamath River. Archaeological evidence also documents use of the upland meadows and plateaus, such as along Fall Creek and in the Soda Mountain area. These areas would have been subject to those techniques the native peoples employed to enhance the resources present, and fire was a significant factor affecting the landscape in the valleys and in the uplands.

Early Explorers

Early explorers and traders began passing through the area in the nineteenth century. Beginning with Peter Skene Ogden in 1827, these people left occasional descriptions of the world through which they passed. These descriptions provide the earliest historic evidence we have of the environment.

Ogden was an employee of the British Hudson's Bay Company, which had a base along the Columbia River to the north. Sent out on a mission to discover and deplete the beaver of the southern Oregon country, Ogden entered the Klamath-Iron Gate Watershed in early February of 1827 (LaLande 1984:40-43). In an area later called "Beaver Basin" and now under Copco Lake, he noted:

> "here we are surrounded by oaks, soft Maple and Grass six inches long and green as in the summer"

His description continued, noting the importance of acorns to the native people, as well as the apparent abundance of this food:

> "I accompanied my Guide and Indian Chief to an Indian Hut...their sole support appears to be Acorns...of these they have a large stock and altho subsisting entirely on them they were well in flesh."

Also at this camp, Ogden's hunters returned "well loaded with meat". Somewhat further downriver, at the mouth of Camp Creek, he states

> "...as far as we can see before us the Country is still very hilly and bare of wood altho along the banks of the River Oaks are numerous".

The picture that arises from these brief descriptions is one consistent with the vision of a landscape well-managed for major staples, such as oak and deer.

Many others would follow in Ogden's footsteps over the next few decades (Dillon 1975). The trappers would deplete the beaver in the streams, following the Hudson's Bay Company policy of creating a "fur desert" to discourage competition from Americans; explorers and other travelers would also spread disease and engage in hostile actions with the local peoples. Some would also comment on the environmental conditions along the trail.

Lieutenant Emmons, a member of the U.S. Navy Exploring Expedition (the Wilkes Expedition) was one such commentator. Traveling south through the Rogue and Shasta valleys in late September and early October of 1841, he noted ridges burning on the Rogue-Klamath divide, and the barren plains of the Shasta valley, blackened by recent grass fires. Yet he found the Shasta River full of fish, and noted antelope, quail, and mountain sheep nearby (Dillon 1975:320).

A few other early descriptions of the environment come from the first surveyors to enter this country shortly after Euro-American settlement in the 1850s. Records from an 1855 railroad survey noted that the summit of the trail crossing the Siskiyous was densely timbered, but that as the trail headed south there were comparatively few trees near the base of the mountains. The surveyor also noted that from the Klamath River south to Yreka the land was mostly rolling prairie country with the hills "covered with bunch grass and entirely devoid of trees" (Webber 1985:235).

These early travelers, of whom Ogden and Emmons were but a few, came through the Klamath-Iron Gate Watershed on their way to other places. None, before the discovery of gold in the early 1850s, came to stay. Yet these people brought a new way of interacting with the land, and their actions affected the landscapes through which they passed.

All of the travelers lived off the land as they passed through. Trappers also removed many beaver, with the intent of hunting them to extinction. Removal of these animals may have affected the watercourses within which they lived, as beaver dams decayed and stream courses became more channeled.

Perhaps more importantly, these early travelers spread disease and pillaged the resources of the native peoples through whose lands they passed. The resulting ill-will culminated in a series of brutal battles during the period of pioneer settlement in the 1850s, known as the Rogue River Indian Wars. At the end of the wars in 1856, surviving native people from the Rogue Valley were removed to distant reservations, and the way of life of those Shasta left in the Shasta Valley was radically changed. The carefully maintained prairies, meadows, and woodlands of the native landscape began to disappear.

After the wars, the Shasta managed to maintain a presence in the Shasta valley and Klamath-Iron Gate area. Today Shasta descendants still use portions of the area to gather various

traditional materials, such as basketry materials and medicinal plants. Certain parts of the landscape, such as Pilot Rock and Sentinel Rock retain sacred significance for the Shasta.

Early Historic Period (1850 - 1900)

Although the watershed does not contain a major settlement, it is tied to the towns and cities nearby, and development in the adjacent Rogue and Shasta Valleys affected use of the land in the watershed. Settlement of the valleys occurred in the 1850s following the discovery of gold in mountains west of the watersheds, and the consequent influx of miners and settlers during that period. Despite some exploratory work in the 20th century, there has been virtually no mining in the watershed (Pickthorn et al. 1990:C3). Following the miners, successful homesteads were established in the valleys along the Klamath River east of Yreka, where the land was suitable for ranching.

In the decades following the removal of the native peoples, the major activities characterizing the new human interactions with the landscape developed. By the turn of the century these interactions had already brought significant changes to the land. These actions included ranching, logging, and agriculture. All involved some degree of resource extraction for economic benefit, and all depended upon the development of a sufficient infrastructure for movement of goods and information throughout the region.

Transportation and Communication

Most of the main routes through the area have a long history, and all were well established by the end of the nineteenth century (Fagan 1994; LaLande 1980; Klamath National Forest map archives).

The route along the Klamath River taken by Ogden in the 1820s followed an Indian trail. In the 1860s this route was improved to a wagon road, known as the Yreka and Canyon City road. It was realigned after the Modoc War in 1875 and became known as the Topsy Road. This road helped promote settlement--for ranching and recreation--in the Klamath Canyon during this period.

The Soda Mt. (Bald Mt.) Road was built in 1927 to follow the power lines coming from Copco dam; it followed an old horse trail (Wright 1954).

The north/south railroad connecting the Shasta and Rogue valleys to other major urban centers was completed in 1887. This development brought a huge boost to the region's economy, providing access to markets for timber, cattle, and agricultural produce (Jones 1980:247-251).

Communication developments were also critical. Local newspapers and regional road networks all appeared during this period, as did the telegraph in the 1880s.

As part of the process of incorporating the landscape into the new society, the federal government sent surveyors to map and record the newly acquired lands. These maps provide some brief descriptions of the land at the beginning of significant Euro-American use, and

after the demise of the native way of life. These are a few examples:

T40S/R3E, Willamette Meridian (WM) (USDI 1894): The survey notes that the area around Soda Mt. and Little Pilot Rock is covered in dense brush and a scattering of timber.

T40S/R4E (WM) (USDI 1873): The area surrounding Jenny Creek and Fall Creek is noted as "timbered with the finest quality sugar and yellow [ponderosa] pine, fir, cedar, and oak."

T41S/R3E (WM) (USDI 1871): A surveyor noted that the area around Camp Creek was "mostly smooth bald hills covered with bunch grass and very well watered with springs and small streams. Along the streams are many small flats suitable for agriculture with good soil. Timber is not plenty but enough for purposes of settlement. It has the appearance of having been extensively used for grazing for many years". The western half of the township is noted as generally barren and rocky and unfit for agriculture.

T41S/R2E (WM) (USDI 1856): The area around Pilot Rock is noted as having a scattering of fir, pine, cedar, and oak, and good grazing.

Ranching and Agriculture

Ranching has been an important economic activity and way of life in the watershed for almost 150 years. Demand from the miners provided local markets for ranchers in the Shasta Valley as early as the 1850s. Despite a slump in mining in the 1860s, local and regional markets led to further development of the industry in the 1860-70s, tied in part to the growing agricultural and timber economy. With the advent of the railroad in the 1880s, ranchers also had greater access to distant markets.

In the Klamath Iron Gate area major ranches were established by the 1880s. The Grieves ranched along Fall Creek and William Wright along Camp Creek, and there were ranches along Brushy Creek and at Horseshoe Ranch on Scotch Creek. Just to the east, outside of the watershed, the Hessigs and Wards established substantial ranches (Hessig 1978). Like the ranchers to the north, those in the Klamath Iron Gate area also used the uplands in the summer to pasture their cattle, with cattle camps at Salt Creek and Soda Mountain among other places (Wright 1954).

Although agriculture has not been as significant in the watershed as it has been elsewhere in the region, developments in agriculture affected the area. In the 1870s the growth of the orchard industry in the Rogue Valley led to a high demand for wood for crates, fueling the growing timber industry in the region. Both the orchard and logging industries, in turn, increased the demand for beef, with local ranchers provisioning loggers in the region (Hessig 1978). A community effort built a large ditch, known as the Grieve de Soza ditch, bringing water from Jenny Creek to Camp Creek in the late nineteenth century. Portions of this ditch are still extant today (Mack 1996; Oetting 1996:105).

Timber

Logging in the watershed was a minor enterprise from the 1850-80s, spurred by the local needs of miners and settlers. Logging took place mainly at lower elevations. Development of the railroad increased access both to markets and to timberlands, especially in the area adjacent to the watershed east of the Cascades.

In the early 1890s, a logging camp was established southeast of Pinehurst on the plateau above the Klamath River (Foley 1994:11-12). With 26 families living there it was the first large scale timber operation established in this area.

The Klamath River Mining Company was established in 1889, and was bought out in 1891 by the Pokegama Sugar Pine Lumber Company. This company secured much of the huge timber reserves on the north Klamath plateau, including the Jenny Creek tract, and built rail lines into the area to log those timberlands. They built a chute at Pokegama, on the north side of the Klamath River just east of the Klamath-Iron Gate Watershed, where logs dropped into the Klamath River and were floated downriver to a mill at Klamathon, just west of the Klamath-Iron Gate Watershed in the vicinity of Hornbrook. From there the Southern Pacific Railroad transported them to markets north and south. In 1901, Pokegama reported cutting 21 million board feet valued at $478,000 (Foley 1994:12).

About the turn of the century, the Pokegama railway was extended from Klamathon up the south bank of the Klamath River, crossing at Fall Creek and heading north to Pokegama, linking California and Oregon. It was originally hoped that this would be the mainline from Yreka to Klamath Falls, but then the line went through the McDoel/Dorris area. The Pokegama railway was used for timber and passengers, but in 1902 the mill at Klamathon burned down and was not replaced. The rail line was out of use for a while, then California-Oregon Power Company (Copco) bought it and used it to haul materials in for the dam, though the lines were in bad shape by then (c. 1910-12). The remains of the line were sold for scrap metal during WWII.

In 1900 Weyerhauser obtained 16,000 acres called the Petton Reid Tract in the Jenny Creek region and 200,000 acres of the Hopkins tract (sugar pine and yellow pine). They also secured options on 20,000 acres of Oregon and California (O&C) lands (Foley 1994:13). Large scale operations didn't begin on these lands, however, until the 1930s.

In 1905 Weyerhaeuser acquired the railroad and timber company, and logged in the area until 1912 (Oetting 1996). Although these companies' major operations took place just outside the Klamath-Iron Gate Watershed, they likely affected the timber reserves in the Fall Creek area. By the end of the nineteenth century, however, access still prevented logging in the higher and more mountainous portions of the watershed.

Hunting and Recreation

Throughout the nineteenth century hunting and trapping continued intensively within the watershed. There was an active market for deer hides and pelts (beaver and other types)

(LaLande 1980:132; Hessig 1978:22). Hunting for sport continued, and ranchers sought to eliminate predators, especially cougars and grizzly bears, dangerous to their stock. Mountain sheep disappeared in the Shasta Valley in the 1880s (Hamusek et al. 1997:32), and the last grizzly bear--old "Reelfoot" was killed just south of Pilot Rock in 1890 (Wright 1954).

With the development of transportation networks and the settlement of the countryside, recreational pastimes became part of the pattern of land use as well. Hot springs at Shovel Creek, just east of the Klamath-Iron Gate Watershed, promoted the development of a hotel and other facilities, as did the mineral waters at Colestein, located on the Siskiyou divide.

Effects Upon the Land

By the turn of the century, the new way of life introduced by Euro-American settlers was well entrenched and had brought significant changes to the land. The native peoples' way of life was gone, as was the careful caretaking philosophy that motivated their interactions with the landscape. Interestingly, the changes brought by the new way of life were not specifically linked to major changes in population; there were probably about as many people actually living within the watershed before and after the shift from a native to a Euro-American way of life. The major changes were due in part to radical differences in economy and technology. These differences were reflected in early development of the infrastructure--roads and communication networks--which facilitated a market economy and the ranching, logging, and agricultural industries which depended upon it.

The Euro-American way of life brought rapid change to certain elements of the local environment. Major predators were hunted down or removed, as were major game animals. The absence of native burning began to change the character of the vegetation, especially of the meadows, prairies and grasslands, and oak and pine woodlands. Grazing, especially the unregulated grazing of the nineteenth century, affected native bunchgrasses. Ranchers burned to promote forage for their stock, but their burning was less discriminate than that of their native predecessors, and often escaped into major fires in the timberlands. Logging began to take out major timber reserves, especially sugar pine, where accessible (LaLande 1980). Agriculture introduced new species to the land, and roads and trails increased traffic of all kinds throughout the area.

There are several testimonies to these changes, written around the turn of the century. A study done in conjunction with the establishment of the national Forest Reserves (precursor to the National Forests), gives a brief, township-by-township description of the lands within part of the adjacent Bear Creek Watershed (Leiberg 1900). In this study the author frequently notes that fires have ravaged much of the timber, that the glades are badly overgrazed, and that some timbered areas have already been culled of their best portions.

Early Twentieth Century (c. 1900 - World War II)

The basic patterns for settlement within the watershed remained largely unchanged during the first half of this century. A few small communities developed. Along the Klamath River, Copco came into being with the arrival of hydroelectric development in that area.

Ranching, Agriculture, Timber

Ranching and agriculture continued to be significant activities in the region. Ranching was primarily affected by the development of government regulations, which were instituted in response to the excesses of the late 19th century and to the continuous conflict among users over the range (Brown n.d.:41; LaLande 1980: 140). The formation of cattle associations helped resolve some of these problems, and the Pilot Rock Grazing District was formed in 1934 to coordinate grazing issues across the California/ Oregon border (USDI n.d.).

Major logging was already declining along the north rim of the Klamath River in the early part of this century. Weyerhaeuser pulled tracks in this area in 1912 and the mill at Pokegama closed (anon.,n.d.). After the First World War, however, technological and transportation improvements led to the establishment of several small mills along the Greensprings, just north of the Klamath-Iron Gate Watershed, which began drawing upon the timber reserves in that area (Foley 1994). In 1929, the Henry Lumber Mill opened on the Greensprings, built by John Higgins Henry and his son John Baldwin Henry. They also built the town of Lincoln in order to house the mill workers. Just after the mill opened, the Great Depression hit and the mill was forced to shut down until 1935 (Foley 1994: 19-21).

Weyerhaeuser restarted operations in 1934 with a major mill northeast of the watershed in Klamath Falls. As elsewhere in the country, however, the Depression of the 1930s served to dampen economic development, and the timber industry slumped until the demand of the Second World War brought new growth to the industry.

New Players in the Watersheds

The early decades of this century also witnessed the arrival of two more significant forces to the region: the federal government, in the form of land management agencies, and companies promoting the development of hydroelectric power.

Partly in response to growing national concern over environmental degradation caused by land use practices of the nineteenth century, and partly out of concern over the loss of economic resources, the federal government instituted a system of federal reserves around the turn of the century. In the early part of the century, the failure of the O & C Railroad to comply with terms and conditions of their land grant resulted in the return of unsold sections of their land to the government. In Oregon, about half of the BLM-managed lands within the Klamath-Iron Gate Watershed came back to the government through this process. In California, BLM-managed lands are those which had remained in the public domain.

Government management in these early days emphasized the regulation of hunting and grazing, and regeneration of the range. Fire suppression and timber management also received a high priority. Fire suppression especially became a mission, particularly in the Forest Service, with long-term consequences to the land. This perspective is eloquently expressed in the following quotes from a 1936 Klamath National Forest brochure:

> "The fire-protection policy of the Forest Service seeks to prevent fires from starting and to suppress quickly those that may start. This established policy is criticized by those who hold that the deliberate and repeated burning of forest lands offers the best method of protecting those lands from the devastation of summer fires. Because prior to the inauguration of systematic protection California timberlands were repeatedly burned over without the complete destruction of the forest, many people have reached the untenable conclusion that the methods of Indian days are the best that can be devised for the present...
>
> The stock argument of those who advocate the 'light burning' of forests is that fire exclusion ultimately leads to the building up of supplies of inflammable material to such an extent that the uncontrollable and completely destroying fire is certain to occur. The experience of the Forest Service in California, after 15 years or more of fire fighting, does not lead to any such conclusion...
>
> Fire exclusion is the only practical principle on which our forests can be handled, if we are to protect what we have and to insure new and more fully stocked forests for the future.."

Fire suppression was taken seriously in the watershed, and a fire lookout was established on Soda Mountain in 1933, and on Parker Mountain in 1943.

Power and light reached the hinterlands of the American West, including the Klamath-Iron Gate Watershed, early in the century. In 1902 the newly formed Siskiyou Electric Power Company constructed the first major hydroelectric project at Fall Creek, with water diverted through a powerhouse and aqueduct producing 2,300 kilowatts of electric power. In 1911 the California-Oregon Power Company (Copco) formed, incorporating the Siskiyou Electric Power Company as well as several other companies. Between 1912-18, Copco built Copco 1 and from 1921-24 Copco 2, both just east of the Klamath-Iron Gate Watershed. In 1911 powerline number 3 ran north into Oregon, and in 1927 line 19 was also constructed. The reservoirs behind the dams inundated several of the major ranches in the area, as well as covering the locations of major Shasta villages occupied in the previous century. In 1961 Pacific Power and Light (now PacifiCorp) merged with Copco, and still manages the hydroelectric facilities in the Klamath Canyon (Dierdorff 1971).

At the time of the first Copco dam construction a fish hatchery was established, together with an egg-taking station at Klamathon, in lieu of a fish ladder around the dam. In 1914 local concern over a demise in migratory fish (such as salmon) above the Copco dam led to an investigation, which discovered that it was not the dam that was blocking fish passage, but the egg-taking station at Klamathon which was the culprit (Boyle 1976:21).

In 1962 Iron Gate dam was built, in part to regulate flows and eliminate controversial fluctuations in flows caused by the Copco structures. As part of a provision for fish, holding tanks and a hatchery owned and operated by the state were built at Iron Gate, again instead of a fish ladder (Dierdorff 1971:278). As at Copco, the Iron Gate reservoir also covered major ranches and sites of earlier Shasta habitation.

Effects Upon the Land

By the middle of the twentieth century the effects of continued development and new policies were apparent on the land. In the 1950s George Wright, long-time resident and "mountain man", reflected on his memories in the early decades of this century, and the changes which had taken place since that time (Wright 1954). Wright remembered fishing for steelhead along Brush Creek, in the Klamath-Iron Gate area, until about the 1920s when fish diminished, probably as a result of the developments associated with Copco. Steelhead also used to run up Camp Creek to the falls at Big Rock, some even ascending the falls to travel further upstream. He also recalled fishing in the spring for mountain trout, up the forks of Camp Creek. He remembered the abundance of salmon on Fall Creek as far as the falls, especially during the month of October, and lots of mountain trout. Other residents of the area also remember fishing for steelhead in Brush Creek, Dry Creek, Little Bogus Creek, and Camp Creek through the 1960s. Though fish runs may not have been as plentiful as earlier, they were still good. Mountain trout were still up Camp Creek, and also up Scotch Creek, in pools above the falls. The flood of 1964 hit these creeks hard, and it took several years for the fish populations to restore themselves. After the Schoheim road was put in, these areas were fished pretty hard (Miller 1999).

Wright described other changes to the land. In the Klamath-Iron Gate area, he recalled Slide Ridge as great bunchgrass range, and a haven for horses. The middle fork of Camp Creek was brushy, though not as bad as it became by the 1950s, and great deer country in the summer and fall. Lone Pine Ridge was originally named for a big, lone pine on the ridge, with no other trees within several hundred yards. He recalled: "In the early days this was a fine winter and spring range for cattle and horses.. always a good supply of bunch grass growing in the hillsides. Roaming bands of horses depleted the bunch grass...". He blamed overgrazing, especially by sheep, for the demise of much of the good grazing lands by the 1920s. He noted particularly that areas along the west branch of Camp Creek were hard hit by cattle and sheep grazing, becoming mostly dust and weeds by the early decades of this century, and that there was a sheep and cattle camp just west of Soda Mt. Salt Creek Ridge had been another good place for horse range, with fine bunch grasses now gone.

Land use practices in the first half of this century continued to foster changes begun in the nineteenth century, although government regulations served to improve some situations. Hunting regulations led to some regeneration of game species, and grazing regulations assisted in slowing the degeneration of the range and in regenerating some lands. However, native grasslands and meadows continued to be transformed. Among the factors affecting this transformation was the introduction of invasive weeds; one local resident remembered starthistle first appearing in the range east of Ashland in the 1930s (Jones 1989:8). Fire suppression policies began to affect the composition of local forests and to further the demise of the more fire resistant oak and pine woodlands. Water and fish resources were affected by the development of major irrigation and hydroelectric facilities.

Late 20th Century

During the second half of the twentieth century developments in transportation and logging

technology, as well as increased demand and substantial increases in prices (from $2.00 to $22.50/million board feet in 1951; Foley 1994:32) made logging possible and profitable throughout the watershed. World War II spurred the economy and the lumber business worked at full production after 1942. Weyerhauser had completed a mill at Klamath Falls in 1929, and dove into production during the war years. Camp Four near the Greensprings Highway, which replaced the earlier Pokegama Camp, provided timber for the Klamath Falls mill. At this time, they began experimenting with sustained-yield management on their Oregon lands.

The main species targeted were sugar and yellow pine. The logging and reforestation practices differed between operators (Foley 1994:33). Some selectively cut, targeting diseased and dying or over-mature trees, leaving enough to reseed areas. Others clearcut and then left without planting, or clearcut, burned the slash, then replanted the area with two-year old seedlings, depending on the economics of the situation.

Growing demand due to increasing local and distant populations also has brought greater recreational development to the area, stimulated in part by access made easy by more roads. Federal land use priorities are reflected in the land use policies of the government, which continues to manage significant portions of the watershed.

SPECIAL AREAS

Pilot Rock Area of Critical Environmental Concern

This ACEC is largely unchanged from its pre-Euro-American condition. Structural and compositional changes to vegetation communities have occurred in all vegetation types because of road building, quarry development, fire suppression, and grazing. Forested stands are becoming overly dense at the understory level with *Abies concolor*. Oak woodlands, shrublands, and savannahs are also becoming overly dense and overmature. Also, these communities have become dominated with weedy species at the forb level.

Scotch Creek Research Natural Area

The chaparral community dominated by rosaceous species seems to have been only slightly impacted by Euro-American influences. Activities such as, grazing and fire suppression have had only transient effects on the condition of this vegetation community. However, the chaparral community dominated by *Ceanothus* and *Arctostaphylos* has seen structural and compositional changes due to these same activities. These vegetation types tend to be overmature and overcrowded, would lack an appropriate amount of young individuals, and the forb layer consists of mostly weedy species.

Cascade/Siskiyou Ecological Emphasis Area

Structural and compositional changes to vegetation communities have occurred in all vegetation types because of Euro-American uses and activities. Forested stands are becoming

overly dense at the understory level with *Abies concolor*. Oak woodlands, shrublands, and savannahs are also becoming overly dense and overmature. Also, these communities have become dominated with weedy species at the forb level.

EROSION PROCESSES

Historical erosion processes in the Klamath-Iron Gate Watershed were very similar to current day processes but total volumes of sediment produced and delivered to streams were somewhat less. The stream-adjacent sideslopes are the most erodible terrain of the watershed. This landform generally has had, and continues to have, the steepest and most incised slopes of the watershed. Types of historical erosion have been mainly sheet, ravel and minor gully erosion. A large volume of sediment has been transported to area streams via sheet erosion and raveling of materials over long periods of time.

The steep sideslopes also contained the most unstable terrain of the watershed. Earthflow landslides, smaller slumps and debris slides have continued over very long periods of time. Mass wasting helped shape today's topography especially in the upper portions of Scotch, Hutton, Slide, Dutch Oven and Camp Creeks. Slightly larger volumes of sediment and debris were produced from these processes than from surface erosion.

Historically, the main natural processes capable of removing extensive soil cover in the watershed were wildfires and floods. Throughout the late nineteenth and early twentieth centuries, large wildfires occurred periodically in the watershed (see Human Uses). These large wildfire occurrences were often very detrimental to water quality and fisheries due to surface erosion and mass wasting that occurred for the following one or two years. The highest erosion rates occurred when there was a high intensity storm event immediately following intense wildfires on erosive soils.

Due to fire suppression activities, topsoil loss has probably been reduced over the past 70 years since there have been fewer natural fires exposing soils. However, this situation sets up a higher risk that a hot burning wildfire might occur, causing severe soil erosion and landslide problems.

Slope instability and erosion processes have increased over time as a result of human influences in addition to the natural disturbances in the Klamath-Iron Gate Watershed (see Current Conditions, Erosion Processes for human impacts).

SOIL PRODUCTIVITY

Historic soil productivity conditions were much the same as they are today in areas that have not had much human disturbance. Productivity in the watershed varies by elevation, aspect, topography and bedrock. Soils on the slopes above Iron Gate Reservoir were inherently deep with fine textures and due to the soils' minerology, they have a high shrink/swell potential.

Consequently, the water supplying capacity of these soils was limited during the summer months resulting in the current vegetation. The soils in the upper portion of the watershed had productivity limitations due to shallow soil depth and high rock content. North and east facing slopes in the upper portions of Scotch, Camp, and Dutch Oven Creeks were the most productive in the watershed as a result of higher rainfall and past vegetation. On south facing slopes however, productivity was lower due to high evapotranspiration demands. Many of the south slopes had shallow, rocky soils that dried out early in the spring. Many of these sites supported only dry meadows or oak woodland.

Along the volcanic ridges, Slide Creek Ridge and Lone Pine Ridge, where soils are shallow and rocky, the site productivity was very low. One of the primary reasons for this was the lack of adequate soil moisture holding capacity and lack of soil development, especially the development of a very thick topsoil. The parent material for many of these soils was very young, originating from volcanic activity that occurred in very recent geologic time. Drying winds and exposure to extreme cold temperatures was another major reason for the low site productivity.

LANDSCAPE VEGETATION PATTERN

The vegetation native to the Klamath-Iron Gate Watershed is a result of time and the unique geology of the area. Over the last 60 million years, vegetation has migrated into this area from six different directions: the Oregon and California coast ranges via the Siskiyou Mountains (red alder, Pacific madrone and bigleaf maple); the Sierras and Cascades (baneberry, Shasta red fir, sugar pine, manzanita spp. and California black oak); the Klamath River corridor, and lowland chaparral area (juniper and mountain mahogany) (Atzet 1994).

Natural change in landscape pattern is inherent; natural succession is continuously changing the vegetation and there is no single stage of a forest that can be considered to be the only natural stage. Leiberg (1900) wrote that previous to 1855, the Native Americans were responsible for frequent, small circumscribed fires which resulted in forest stands with diverse age classes. Leiberg also notes that much of the forested area and timber is badly burned. Therefore, the Native Americans created forest stands with various patch sizes.

After Euro-Americans arrived, the forest stands probably became more open (fewer vegetation stems on a unit of size basis) and the forest patch size probably increased because of logging and the more frequent use of fire for various reasons. Because of the frequent disturbance there was more vegetation in the early and mid-seral stages of development. Mature and old-growth fire resistant trees species, such as pine species, Douglas-fir, and incense cedar with thick bark survived the fires.

According to the 1947 forest type map created by the Pacific Northwest Forest and Range Experiment Station (USDA 1947) the forests within the watershed were predominantly composed of pine and pine mixtures. The northern half was mapped as white fir, Douglas-fir, and ponderosa pine. There were larger expanses of grasslands, woodlands, and non-commercial rocky sites scattered across the landscape as well. In the lowlands of the southern

portion of the watershed, larger patch sizes of grassland and oak-juniper woodland were present. The higher elevations to the east were composed of large patches of large diameter Douglas-fir, pine, white fir, and incense cedar.

Fire was the primary biotic process influencing the vegetation landscape pattern. Dense patches of trees were probably subject to bark beetle attack when high stocking levels were present in conjunction with drought conditions. Pathogens were probably less noticeable because of a higher diversity of species making up the forest stands.

PLANT SPECIES AND HABITATS

Non-Native Plant Species and Noxious Weeds

Historically, herbaceous vegetation layers at all elevations in all habitats were composed of native plants. Herbaceous native vegetation layers at lower elevations stayed greener later in the summer and probably produced less yearly flashy fuels. This presumably helped to keep wildfires at lower intensities. Native plant species diversity was higher in open areas at lower elevations. Pioneer native plant species colonized disturbed areas more readily than non-natives species.

A list of historically introduced plant species that commonly occur on rangelands within the Klamath-Iron Gate Watershed appears in Appendix E. Little is known about the points of origin and distribution of these plants, a few of which are designated noxious weeds by the Oregon Department of Agriculture. Logical speculation favors assumptions that these weeds, as well as less pernicious species, were intentionally brought in by settlers for inclusion in gardens and then escaped, or were carried into the watershed by animals or transport conveyances in early days as is known to be typical today. Long established non-native plant species in the watershed include: cheatgrass, ripgut brome, medusahead rye, hedgehog dogtail, bulbous bluegrass, St. Johnswort (Klamath weed), and yellow starthistle.

Special Status Plant Species and Habitats
Survey and Manage Plant Species and Habitats

In 1841, the United States Exploring Expedition passed through this area. This early scientific expedition included two botanists and several naturalists. These botanists collected specimens of vascular plants, fungi, mosses, algae, and lichens that were later identified by leading scientists specializing in these groups (Wilkes 1862; McKelvey 1956).

A review of the species lists from 1841 showed none of the species currently on either the Special Status Species list or the Survey and Manage Species list. Specific population and distribution data for this time does not exist but the data suggests that these species were uncommon prior to Euro-American settlement.

Habitats that support the known species of rare plants in the watershed have declined in area and in condition. Historical accounts of explorers and early forest inventories indicate more

large diameter coniferous forests with different overstory and understory composition and structure. Also, much of the valleys were indicated to have been open oak woodlands and savannahs. The shrublands were maintained in a more open state. Obviously, the impacts and occurrences of non-native plants would have been minor to nonexistent prior to Euro-American settlement.

FOREST DENSITY AND VIGOR

Core samples from ponderosa pine, sugar pine, incense cedar, and white fir between the ages of 123 and 243 years indicate that these present day, large diameter trees were free to grow when they first became established (USDI 1998). This indicates low stocking levels or more open growing conditions. Sample trees grew 3 to 4 inches per decade in diameter and the diameter growth rate gradually decreased to 1.5 inches per decade over a period of 40 to 100 years. Some incense cedar sample trees showed suppression at the time of establishment. This could be explained by the fact that incense cedar are shade tolerant and these trees grew with more competition. Tree diameter growth has been below 1.5 inches per decade since 1928 or before.

Historical information is somewhat misleading in regard to actual tree stocking levels early in the 1900s. Although forest mapping indicated that there were few large trees on a per acre basis, natural regeneration was abundant. There were probably thousands of seedlings per acre on the moist, forest sites. The 1947 USDA maps indicate that beneath the large diameter overstory, there was a white fir, Douglas fir, incense cedar, and sugar pine understory.

As tree growth and vigor declined late in the 1920s, bark beetles probably started to become an important factor in changing the height and size class structure of the forests. The western pine bark beetle caused mortality in the large diameter ponderosa pine, the mountain pine beetle in patches of small diameter pine species, and the Douglas-fir bark beetle in suppressed Douglas-fir trees. Pathogens (root rot diseases) probably became more apparent as more even-aged stands became established and matured.

Forest stands are dynamic in nature and will continue to change in stocking levels and species composition over time.

FIRE AND AIR QUALITY

The historical fire regime of this watershed was characterized by frequent (1 to 25 years) and widespread fires resulting from the hot, dry summers. Accounts documented by early settlers of Oregon indicate that wildfires were common, widespread, and produced substantial amounts of smoke which impacted visibility and the health of local residents (Morris 1934). These periodic fires consumed understory and ground fuels thus leaving a large gap between the overstory and ground. This in turn reduced the probability of a crown fire. Typically, fire intensity was low because frequent fires limited the time for fuel accumulation. Consequently, the effects of individual fires on flora, fuels, and fauna were minor, creating a more stable

ecosystem.

Fires maintained most valley bottomlands and foothills as grasslands or open savannas. Forests created from frequent, low intensity fires have been described as open and park-like, uneven-aged stands characterized by a mosaic of even-aged groups. Ponderosa pine, Douglas-fir, sugar pine, and white fir were the most common species. Depending on understory vegetation conditions, these species have some resistance to fire as mature trees. As saplings, ponderosa pine is the most resistant followed by sugar pine, Douglas-fir, and white fir. Frequent fires had major structural effects on young trees favoring ponderosa pine as a dominant species and white fir as the least dominant in this forest type. Without fire, Douglas-fir and white fir became the dominant species because these species are more tolerant of understory competition than the pine species.

Wildfires were likely the primary emissions source that influenced air quality. During summer and early fall, ongoing wildfires, ignited by lightning, would flare up as weather conditions allowed. This likely caused intermittent smoke episodes throughout the region.

TERRESTRIAL WILDLIFE SPECIES AND HABITATS

Wildlife - General

Prior to Euro-American contact, Native Americans influenced habitat conditions throughout the watershed by burning. The natives routinely burned areas to maintain conditions suitable for the plants and animals they relied on for their subsistence, including roots, tarweed, deer, and elk. The native burning maintained an early seral condition primarily in the grasslands, shrublands, and mountain meadows, but early records indicate some forested areas were also burned. Due to the habitat conditions created by these burns, deer and other species preferring early seral conditions in the various plant communities were probably quite abundant.

Grizzly bear, gray wolf, and other carnivores were probably found from the valley floor up and into the plateau. Healthy populations of beaver were likely present in the low gradient portions of most rivers and streams in the watershed. Beaver populations, however, were probably decimated in the early and mid-1800s by Euro-American trappers.

Obviously, Iron Gate Reservoir was not present prior to Euro-American contact, and some species associated with it were not present, but the Klamath River provided habitat for waterfowl and other riverine species.

With some notable exceptions, the present assemblage of upland species in the watershed was likely present prior to Euro-American contact since all of the habitats are still represented, although the relative abundance and condition are quite different. Species that have been extirpated from the watershed include pronghorn, grizzly bear, and gray wolf. Common introduced species include European starling and house sparrow.

Threatened/Endangered Species

The northern spotted owl and bald eagle, both threatened species, are present in the watershed, and are presumed to have also been present in the early to mid-1800s. Although the presence of these species could not be confirmed, habitat conditions at that time would indicate their presence. The Landscape Vegetation Pattern section of the watershed analysis describes the Fall Creek portion of the watershed as having large patches of large diameter Douglas-fir, pine, white fir and incense cedar. This type of vegetation would provide habitat for spotted owls. Also, given the present condition of the upper and mid-elevation segments of Scotch Creek, Camp Creek, and Dutch Oven Creek, these areas also probably provided habitat for spotted owls. The salmon and steelhead runs in the Klamath River, prior to the building of Iron Gate dam/reservoir, provided an adequate forage base for bald eagles so they were likely present.

Northern Spotted Owl Critical Habitat

Reference conditions for northern spotted owl critical habitat will be addressed on the basis for its designation in 1992 since critical habitat did not exist in the early to mid-1800s. Critical habitat is designated under the auspices of the Endangered Species Act of 1973. The designated critical habitat in the watershed was established to provide for nesting, roosting, foraging and dispersal habitat in an area of high habitat fragmentation to help in providing a habitat link between the Western Cascade and Klamath Mountains physiographic province (USDI 1994a).

Special Status Species

Based on the habitat associations assumed to be present in the watershed in the early to mid-1800s, all currently designated special status species were likely present at that time (see Current Conditions, Terrestrial Wildlife Species and Habitats). Since many of the threats associated with their current status were generally of no consequence prior to Euro-American presence, populations of the various species were probably greater and more stable.

Survey and Manage Species and Protection Buffer Species

As with the special status species, it can be assumed that the survey and manage species known or believed to be present in the watershed (see Current Conditions, Terrestrial Wildlife Species and Habitats) were present in the watershed when Euro-Americans arrived. All of these species appear to be positively associated with mature/old-growth conifer forest; since threats to the species were minimal, populations were probably greater than today and more stable.

Black-Tailed Deer

Black-tailed deer were an important source of food for the pre-historic native inhabitants in the watershed, and they managed the land (primarily by burning) to ensure good habitat conditions for this and other ungulate species. The herd(s) were migratory and the native Americans

maintained the habitat on both the summer and winter ranges. On the summer ranges, meadows were burned to improve herbaceous forage condition, and on the winter ranges, grassland, oak-woodland and shrubland habitats were burned to improve herbaceous, mast, and browse forage conditions. Due to the maintenance of habitat through burning, populations probably remained quite stable during the pre-historic period.

HYDROLOGY

Prior to the introduction of irrigation and dams in the Klamath-Iron Gate Watershed, summer streamflows were directly related to the amount and timing of precipitation events. Years of high rainfall and large spring snow packs resulted in summer flows that provided adequate water supplies for aquatic dependent species. Drought years produced low flows and likely there were some dry stream channels by the end of the summer.

Historically, major flood events were generally the result of rain-on-snow events. The most severe floods in southwestern Oregon took place in 1853, 1861, 1890, 1927, 1948, 1955, 1964, 1974 (LaLande 1995), and 1997. The highest discharge recorded at the Klamath River gaging station below Iron Gate Dam occurred on December 22, 1964. The completion of Iron Gate Dam in 1962 altered the winter streamflow regime in the Klamath River by storing the winter runoff and moderating the peak flows occurring downstream.

Historic low flows in the watershed were associated with years of low precipitation. Drought conditions for southwestern Oregon were noted in 1841, 1864, 1869-1874, 1882-1885, 1889, 1892, 1902, 1905, 1910, 1914-1917, 1928-1935, 1946-1947, 1949, 1959, 1967-1968, 1985-1988, 1990-1992, and 1994 (LaLande 1995; NOAA 1996). One of the first irrigation systems in the watershed was the Grieve de Soza ditch that was built in the late 19th century to carry water from Jenny Creek to Camp Creek. Irrigation withdrawals continued in the late 1800s and became more extensive in the early 1900s greatly reducing summer streamflows in the lower reaches of major streams. The first hydroelectric project to divert water from Fall Creek was built in 1902. The City of Yreka began withdrawing water from the lower reach of Fall Creek in 1969 for municipal use. The transfer of water from Spring Creek increased summer flows in the mainstem of Fall Creek. The Copco and Iron Gate Reservoirs have improved summer flows in the Klamath River.

STREAM CHANNEL

Prior to Euro-American influences, the Klamath River was a free flowing river that experienced normal events of flooding and drought. Bedload materials originating from upper reaches of the river and its tributaries moved through the area, or were deposited on the floodplain. The watershed likely had adequate amounts of large woody material to provide channel structure and dissipate the energy of peak flows. Lower reaches of Camp and Scotch Creeks probably had greater sinuosities, side channels, some braiding, lower width/depth ratios, an ample amount of large woody material, and accessible floodplains with only natural channel constrictions. Floodplain and meander widths were likely somewhat wider than they

are today. Conditions in the upper reaches of Fall Creek were probably similar in areas with flat gradients. Beavers occupied these streams prior to the advent of fur-trappers (around 1830) and built dams that added woody material to systems. The woody material trapped and stored fine sediments, and reduced water velocities. The reduced beaver populations and their dams caused more frequent scouring of channel beds and banks and reduced the water storage ability of these streams.

Lower reaches of the streams flowing into the Klamath River were inundated upon completion of the Iron Gate Reservoir. Other changes to Fall Creek included the transfer of Spring Creek water into the stream system and the diversions for the power plant and Yreka water supply. Activities such as fur trapping, grazing, conversion of riparian zones to agricultural pastures, logging, and road building were the major human-caused disturbances that affected the watershed and ultimately the stream channels.

Large numbers of cattle and sheep were introduced in the watershed in the mid-1800s and heavy livestock use continued until the early 1900s. Watering opportunities outside stream corridors were limited therefore livestock tended to concentrate in these areas and likely caused stream bank deterioration as they moved in and out of channels.

Early ranchers needed a supply of lumber for various building needs and either cut readily available trees for this purpose, or bought materials from someone else. Many of the readily available trees were along stream bottoms close to roads. As time progressed, logging and milling of lumber became larger ventures. Land clearing for agricultural use and construction of roads resulted in the removal of trees and large woody material from stream banks, particularly in the lower segments of Scotch and Camp Creeks. Floods became more destructive without sufficient instream structure to slow the high stream energy. As more streambank erosion occurred, some portions of the channels widened, and other portions became entrenched.

Roads were constructed adjacent to portions of streams. These actions may have confined some reaches of the channels, which restricted the natural tendency of streams to move laterally.

WATER QUALITY

Water quality in the Klamath-Iron Gate Watershed was probably very good prior to Euro-American settlement: low summer water temperatures, acceptable chemical and biological parameters, and low sediment/turbidity levels. This was due to the wide, diverse riparian zones, low width/depth ratios, greater summer flows, and low sediment input. Higher fire frequencies prior to fire suppression may have resulted in periodic episodes of sparse riparian vegetation along some stream reaches and subsequent higher stream temperatures until the riparian vegetation became reestablished.

Land clearing activities in the late 1800s and early 1900s resulted in a reduction of riparian vegetation allowing more solar radiation to reach the streams. Increased water temperatures

were likely a result of this activity. Irrigation withdrawals during this same time period lowered summer streamflows and contributed to increased stream temperatures. Logging in the mid-1900s contributed to increased water temperatures as trees within the riparian zones were harvested. Logging also resulted in less large woody material in the stream channels. Road construction adjacent to streams resulted in reduced riparian vegetation and channelization. Loss of large wood and stream channelization resulted in greater width/depth ratios. Wide, shallow streams tend to have higher stream temperatures.

Ground-disturbing activities such as road building, logging, land clearing, agriculture, and concentrated livestock grazing contributed sediment to streams. Sediment and turbidity levels increased substantially after extensive logging and associated road building occurred, especially on steep slopes.

Livestock concentrations adjacent to and in streams likely resulted in increased fecal coliform levels.

RIPARIAN AREAS

Historically, the lower reaches of Camp, Scotch and Falls Creeks, those now inundated by Iron Gate Reservoir, presumably had riparian vegetation consisting of oaks, willow, alder, Oregon ash and perhaps some cottonwood. It is also assumed that these vegetated corridors were wider than what we now see above the reservoir. The activities that affected the stream channels also affected riparian vegetation. In some areas, roads and clearing for agriculture reduced riparian width and early livestock grazing and logging altered the diversity of age and species composition of brush and trees. In other areas, the present day age and species composition are probably quite similar to historical conditions of the 1800s. Wildfire has most likely had some affect on portions of the watershed and riparian vegetation in the last century, but the frequency and intensity has not been as pronounced as historic fire events resulting from lightning and Native American induced fires. Consequently, oak woodland and shrubland riparian areas may have been less dense and composed more of early seral stage vegetation than what exists today.

The upper reaches of Fall Creek experienced more logging in the earlier half of the century than the other two forested subwatersheds. Typically, large pine and Douglas fir were high-graded from the forest stands and those that were most accessible were logged first. It is likely that many of the trees providing stream shade from within or adjacent to riparian areas were logged during this period. Smaller diameter trees were subsequently logged in more recent years.

AQUATIC WILDLIFE SPECIES AND HABITATS

Stream Habitat

The most significant change to stream habitat in the watershed was the construction of Iron Gate Dam on the Klamath River. What was once a free-flowing river reach with natural fluctuations in flow and temperature, sinuosity, pools and riffles and a floodplain is now impounded water. Lower reaches of Scotch, Camp and Falls Creeks were also transformed from natural stream environments to standing water.

Fall Creek was historically supplied by snowmelt and spring water and flowed un-impeded from its lofty headwaters to the Klamath River. In the natural course of events, it ran deep and swift as winter snows melted in the spring, then settled down to a much reduced mountain stream as summer progressed. Even before the turn of the century, Fall Creek was dammed and diverted to generate hydroelectric power. Later, cold, clear water from Spring Creek was diverted to Fall Creek to augment the flow for power generation and domestic water supply.

Throughout the watershed, riparian areas were comprised of diverse stands of hardwood and conifer forests. Large woody material was generally abundant and was resupplied by a resident population of beavers. Gravel deposits were fairly abundant and supplied resident trout and steelhead with suitable spawning habitat. Pools, riffles and undercut banks provided ample areas for complex populations of macroinvertebrates and hiding cover for fish. Streams were in a more stable condition and able to adjust to fluctuations in streamflow and sediment loads with floodplain connectivity and building of bars and terraces. Complex aquatic habitat types began to simplify as beaver populations were reduced, livestock grazing increased, and roads and logging proliferated. Spawning gravels and other substrate material were scoured to bedrock in many locations, and deeper pools were filled. Elsewhere, substrate material became impacted with sediment. Much of the large woody material was dislodged and swept downstream. Banks which had maintained a degree of stability became washed and eroded. Logging and road building resulted in accelerated snow melt and runoff, consequently, perennial streams became intermittent and were reduced in their value for producing fish and other aquatic resources.

Species

Historically, anadromous fish, primarily chinook salmon and steelhead, migrated up the Klamath River to upstream spawning areas. Several of the tributaries also supported steelhead, including Camp and Fall Creeks, and possibly Scotch Creek. Native resident trout were in good supply in the river and accessible portions of tributaries. Lampreys, suckers, and dace filled niches and populations flourished. An assortment of macroinvertebrate species and amphibians took advantage of cool water and stream complexity to fulfill life history requirements.

Native Americans were well established along the Klamath River. The river's fishery resources, particularly anadromous fish, added significantly to their food supply.

When Copco Dam was constructed near the beginning of the century, anadromous fish runs above that site in the Klamath River were curtailed. With the completion of Iron Gate Dam, another segment of the river, as well as the tributaries in the watershed, were also removed from use by anadromous fish. Resident trout in the river and lower portions of the tributaries were replaced by non-native trout and warm-water game fish. Trout populations in tributaries above natural barriers continue to reproduce, but presumably at a reduced level due to decreased habitat quality.

Redband trout from the Jenny Creek Watershed now have access to upper Fall Creek via the diversion from Spring Creek. The degree of hybridization between trout in the two stream systems is not clear, but electrophoritic comparisons suggest some similarity (Currens 1990).

SYNTHESIS AND INTERPRETATION

The purpose of the Synthesis and Interpretation section is to compare current and reference conditions of specific ecosystem elements and to explain significant differences, similarities, or trends and their causes.

HUMAN USES

History

Two radically different patterns have characterized land use in the Klamath-Iron Gate Watershed. For thousands of years, indigenous people followed a hunting-fishing-gathering way of life, based on a small-scale, subsistence-oriented economy. Approximately 150 years ago, the advent of Euro-American settlement brought fundamentally different land use patterns based on complex technologies and an economic system connected to global markets.

Prior to this change, native people managed the land by working with natural processes, such as fire, to enhance a broad spectrum of resources important to them. Indigenous technologies combined the use of simple tools with a sophisticated understanding of the landscape to promote habitat for game animals and abundant vegetable products needed for food and materials. This way of life promoted an open landscape, with extensive grasslands and meadows, and stands of oak and pine.

This pattern of resource enhancement gave way to patterns of resource extraction, beginning with the actions of the first fur trappers in the early nineteenth century. Following the trappers and explorers, the Klamath-Iron Gate Watershed became home to settlers who brought with them increasingly powerful technologies, as well as attitudes that promoted the transformation of the native environment through a wide variety of actions.

Ranching and logging in the late nineteenth century brought significant changes to the land, stimulated by the advent of the railroad at that time. In the twentieth century, government policies and regulations, further developments in local transportation, hydroelectric power, and recreational pursuits have brought other significant influences to the land.

Major Changes

The last 150 years have contributed to substantial changes in the landscape of the watershed. In the nineteenth century, newcomers introduced a host of new plant (agricultural crops and weeds) and animal (farm and ranch animals) species; plowed under native meadows for farms and degraded grasslands and prairies through unregulated grazing; dammed and diverted streams for irrigation; logged the most accessible timber stands (especially sugar pine); and hunted unwanted predators (grizzly bears and wolves) and other species (antelope and bighorn sheep) to local extinction. In the twentieth century, the federal government has taken an

increasingly active role in managing the lands, and hydroelectric power has changed the landscape and hydrology through construction of several dams and reservoirs. Logging has expanded with the post-World War II explosion of roads and improvements in transportation; fire suppression has affected the local vegetation; and a host of state, federal, and local policies guide human operations on both public and private lands.

The effects of these actions are written on the land: the hydrology and fisheries of the watershed have been altered through irrigation, water withdrawals, dams, roads, and other actions; erosion is more severe in some places than in the past; soil productivity has been affected in some areas by compaction, hot fires, and changes in vegetation patterns; vegetation patterns have been altered through fire suppression, grazing, and other actions; topography has changed in places through the construction of roads, dams, and stream alterations; and native species (plants and animals) have disappeared or become reduced as a result of a number of processes including early unregulated hunting and grazing and through competition with non-native species.

Transportation System

Roads contribute the greatest amount of sediment to streams in the watershed. Roads located in unstable areas and adjacent to streams, as well as those with inadequate drainage control and maintenance and no surfacing are most likely to cause sedimentation of stream habitats. Stream-adjacent roads confine the channel and restrict the natural tendency of streams to move laterally.

Maintenance work on the Schoheim road in the fall of 1998 greatly improved the drainage and reduced erosion on the portion (approximately 12 miles) that was repaired. Closing this road during the wet season is critical to maintaining the proper drainage and preventing damage from off-highway vehicles (OHVs). Issues associated with the Schoheim road as well as possible management options are presented in Appendix H. Alternatives for future management of the Schoheim road will be analyzed in the Cascade/Siskiyou Ecological Emphasis Area Plan being developed in 1999-2000.

Forest roads diminish soil productivity simply by taking the area they occupy out of production. This, traditionally, has been viewed as "the cost of doing business." There is no natural occurrence that can be compared to road construction. A maintained road surface is out of production as long as it is maintained. Vegetation may fill in the road surface when maintenance is stopped, but the growth rate is far less than for undisturbed soil. Four miles of road per square mile is roughly equivalent to 16 acres per square mile that is taken out of production.

Roads affect wildlife in two primary ways: habitat removal and altered behavioral patterns. Construction of roads inevitably removes habitat for various wildlife species. Vehicles using roads disturb wildlife and change behavioral patterns. Habitat within varying distances of roads is not used to the extent it would be if the roads were not present. This may have a far greater impact on wildlife than the immediate loss of habitat. There is little disturbance to wildlife from roads that are totally closed to vehicles. Roads crossing through riparian areas

also tend to fragment riparian habitat connectivity. Some culverts impede or prevent fish passage.

Trends

Ranching, logging, hydropower, and recreation will probably continue as significant human uses of the land. Issues regarding grazing and logging, land allocations, access, roads, ecosystem health, and appropriate use of the land are likely to remain significant in the watershed. The advent of ecosystem management suggests a shift from an extractive perspective to one combining economic concerns with stewardship practices. Given the high percentage of watershed land under federal management, federal land management policies will continue to have a significant effect in the watershed.

Policy Implementation

The twentieth century has witnessed the advent of federal land management policies that affect a large proportion of the watershed's lands. Fire suppression policies have operated with timber harvest to change the character of the forests in the watershed, and numerous laws and regulations now guide human actions on these federal lands.

SPECIAL AREAS

Factors contributing to coniferous forest habitat alteration in the special areas include timber harvesting, fire suppression, vegetation conversion, and rural development.

Factors contributing directly to oak woodland, shrubland, and savannah habitat alteration include vegetation conversion for agricultural uses, plant collection, woodcutting for fuel and other uses, urban and rural development, road building, rock source development, water impoundments and diversions. Factors contributing indirectly to oak woodland, shrubland, and savannah habitat alteration include fire suppression, introduction of non-native plants, distribution of native pollinators, plant community fragmentation, and overgrazing. Some of these habitat alterations should be considered irreversible for management purposes, such as, existing roads, quarries, water impoundments and diversions, and land converted for human uses.

Habitat conditions should move toward a more natural state with the proposed management objectives and recommendations and current silviculture and prescribed fire techniques. Prescriptions designed to simulate ecological conditions and events of a pre Euro-American settlement condition should be effective over time.

EROSION PROCESSES

Natural erosion processes have been altered and/or accelerated by human management and

activities such as road building, timber harvest, grazing, wildfire, and prescribed burning.

Major storms such as the 1964, 1974, and 1997 rain-on-snow events caused both natural and management related slides to transport sediment to nearby streams. Several earthflows and debris flows were reactivated mainly along the steep sideslopes adjacent to Dutch Oven, Camp, and Slide Creeks. New slides also occurred in this steep terrain. The East Fork of Camp Creek has recently been documented as having high sedimentation rates as a result of logging and road use during the wet season. The Schoheim road experienced major rutting and gullying where drainage facilities were inadequate or vehicle use prevented the water from reaching the designed drainage structures. Although a portion (approx. 12 miles) of the Schoheim road has been repaired and closed during the wet season to alleviate this problem, it continues to be a major sediment source east of Lone Pine Ridge.

Road density is another factor to consider when examining road effects related to sediment production. Most of this watershed has low road densities except for the Fall Creek area on the northwest side of Grizzly Mountain. The amount of roads, both private and public, in this area are slightly above 4 miles of road per section.

The increase in fuel loading due to fire suppression in the Klamath-Iron Gate Watershed has increased the potential for a high intensity wildfire. High intensity fires can burn off the duff layers that protect soils from erosive and gravitational forces. These fires may also cause soils to become hydrophobic (soils that do not allow penetration of rainfall and snow melt), which results in much less infiltration and a higher risk for soil erosion and topsoil loss. A high intensity wildfire in the steep, stream-adjacent sideslopes would increase the potential for landsliding and severe erosion for at least one to two years following a fire.

Concentrations of cattle and sheep along streams, ponds, and other wetlands may have contributed to a loss of vegetative cover and subsequent erosion in the riparian areas. Erosion from grazing is most severe near streams and on steep slopes.

SOIL PRODUCTIVITY

Natural levels of soil productivity have been reduced where ground-based logging has occurred in the Fall Creek area. Tractor logged areas with designated skid roads have soil productivity losses ranging from 5 to 10 percent, while areas with unrestricted tractor logging have soil productivity losses near 20 percent. The majority of the soil in this area is fine textured with a large amount of fine pore space and a lesser amount of medium pore space. Actions that further reduce the amount of medium pore space in these soils limit the availability of water and gas exchange, particularly hydrogen. In addition, once the soil in the area has been compacted, ameliorative efforts such as ripping often further limit soil productivity by loosening cobbles and boulders that are then lifted to the surface as a result of frost heaving. Livestock have minimal influence on reducing soil productivity through compaction, except in areas where they concentrate such as water sources. Soil erosion associated with skid and jeep roads has reduced soil productivity.

Soil productivity in this watershed is mainly limited by precipitation. The increase in erosion rates, as a result of land management actions in the Grizzly Mountain area, have decreased soil depth and the amount of topsoil available to supply water and plant nutrients. Road building has taken land out of production and has indirectly reduced soil productivity by increasing landslides and slumping. Clearcutting, burning, and historical over-grazing may have contributed to diminished soil productivity by increasing erosion rates and reducing native vegetative cover and plant material that would otherwise be recycled into the soil. Timber harvest and associated burning have also reduced the amount of coarse woody material across the landscape. There is usually a high amount of insect and small mammal activity associated with large logs on the ground in the forest. Additionally, coarse woody material and surrounding soil retains moisture longer into the summer providing a refugia for insects and soil microbes that decompose organic matter into plant nutrients. Although individual occurrences may not be significant, cumulative effects to the soil could be very limiting over a long period. Most of timbered areas in this watershed have adequate amounts of coarse wood on the ground. The upper Fall Creek area may be the exception as intense management activities have occurred in the recent past. The biggest threat to soil productivity is the potential of a long duration, intense wildfire that would drastically reduce vegetative cover and increase soil erosion.

LANDSCAPE VEGETATION PATTERN

Fire suppression, plant succession, and logging are the main processes that have designed the landscape since the turn of the century. In the Soda Mountain/Little Pilot Rock and Copco Road areas, the forest land matrix has become more contiguous and larger in size because of the lack of fire disturbance and the process of plant succession. These two factors have allowed high stocking levels of trees and shrubs to become established. Forest management selection methods and small sized patch cuts have allowed for the creation of distinct patches within the matrix and have simulated fire in regard to maintaining open patches in the landscape pattern, but have not lowered vegetation densities in the remainder of the forest.

Clearcut harvests (less than 40 acres) in the Soda Mountain area have interrupted the historic continuous forest matrix by creating a pattern of dispersed uniform openings across the landscape. The present day clearcut openings are more uniform than the variable patchiness created by historic fires.

Although there are more non-native species present today and their abundance is greater than in historic times, these species have not influenced the vegetation pattern across the landscape to any large extent. Since these non-native species are herbaceous in form they are commonly found in the grasslands, shrublands, and agricultural areas, and may tend to maintain the openness of these areas. The effects of non-native species on native species are more subtle. In general, natural succession of native species is usually retarded by the non-native species invading their habitat and out competing them for water, nutrients, and light. Suitability decreases as native species decrease in abundance and decreases the quality of wildlife habitat, agricultural productivity, and recreation areas. The effects of the loss of native species is probably not yet realized.

PLANT SPECIES AND HABITATS

Non-Native Plant Species and Noxious Weeds

Noxious weed populations appear to be increasing in the watershed. The economical and ecological elimination of some species such as yellow starthistle is unlikely. If present trends continue, the ability to control other species will also diminish.

Noxious weed populations must be located quickly to increase the effectiveness of control efforts. The Oregon Department of Agriculture is focusing research on identifying biological control agents. Biological control agents are successful at controlling some species. This control method appears promising for several species, although, it is still too early to draw any definitive conclusions.

Most of the problem species are strong colonizers and persistent once established. Any disturbance event such as poorly managed livestock grazing, fire, earth-moving and soil-exposing activities is an opportunity for these species to spread. A number of them will spread into suitable habitats without disturbance. Interactions in some lower elevation plant communities that were once maintained by fire have probably changed. The presence and dominance of non-native annual grasses may now be a controlling influence on plant community development following a fire or other disturbance event.

Deliberate introductions of non-native forage grasses has occurred in some high elevation, moist meadows in this watershed. In addition, erosion control seeding has introduced some permanent and aggressive exotics in our uplands.

Carefully designed grazing systems and certain kinds of prescribed fire may be less damaging or even beneficial to native plant communities. Implementation of these types of management actions may have economic and political constraints.

Special Status Plant Species and Habitats

For the special status species known to occur in the Klamath-Iron Gate Watershed, habitat condition of the oak woodlands, shrublands, and savannahs is critical. Since Euro-American settlement, most habitats have been altered directly or indirectly. Often these alterations would be considered as having negative effects on rare plant habitat. Commonly, for plants that have very specific habitat requirements, alteration of site conditions results in an unsuitable environment.

Factors contributing directly to oak woodland, shrubland, and savannah habitat alteration include vegetation conversion for agricultural uses, plant collection, woodcutting for fuel and other uses, urban and rural development, road building, rock source development, water impoundments and diversions. Factors contributing indirectly to oak woodland, shrubland, and savannah habitat alteration include fire suppression, introduction of non-native plants, distribution of native pollinators, plant community fragmentation, and over-grazing. Some of these habitat alterations should be considered irreversible for management purposes, such as,

existing roads, quarries, water impoundments and diversions, and land converted for human uses.

Habitat conditions should improve with the proposed management objectives and recommendations and current silviculture and prescribed fire techniques. Prescriptions designed to simulate or move a plant community toward a pre Euro-American settlement conditions should be effective over time.

Survey and Mange Plant Species and Habitats

All survey and manage species known to occur in the watershed are found in high elevation, large diameter coniferous forests. This habitat type has been affected by past timber harvest, fire suppression, road building, wood chip material salvage, firewood cutting, introduction of non-native plants, decreased diversity, distribution of native pollinators, plant community fragmentation, and over-grazing.

Habitat conditions should improve with proposed management objectives and recommendations and current silviculture and prescribed fire techniques. Density management, fire hazard reduction, uneven-age management, patch treatments, species composition manipulation, etc. should direct the plant community to a pre Euro-American settlement condition.

FOREST DENSITY AND VIGOR

Core samples from 123 to 243 year-old trees (trees that became established in the 1700s and 1800s) show they were growing at least 1.5 inches in diameter every decade for 5 to 12 decades before a decline in diameter growth started. This indicates that these trees that are now considered to have late-successional characteristics, grew with no or little surrounding tree competition. Frequent fires kept tree stocking levels low. The present day, younger tree age classes, which became established in the late 1800s or early 1900s and now predominate the landscape, grew under maximum stocking conditions and do not show periods of rapid diameter growth. High tree stocking levels have been maintained since Native Americans stopped using fire across the landscape and fire suppression was initiated. As a result, there are more uniform forest stands in the Soda Mountain/Little Pilot Rock and Copco Road areas.

The species composition of the present day forests is also different from the forests of the 1700s and 1800s. Historically, forests had more pine species, incense cedar, and oak species. With the reduction in fire frequency, natural plant succession has allowed more shade tolerant species such as Douglas-fir and true fir to dominate the species composition of the forests, including some dry sites. This is not desirable because the pine species and incense cedar have better drought resistant characteristics that can influence tree vigor.

The decrease in fire frequency has also allowed natural plant succession to change the species composition and structure of grasslands, shrublands, and oak woodlands. Shrubs and trees have invaded grasslands, decreasing the size of these open, native grass communities. The historic, relatively open, shrublands have become overstocked, more uniform in structure, and

present a severe fire danger today. The open oak woodlands that were managed for acorns by the Native Americans have also changed dramatically. Shrub species have invaded the woodlands because of fire suppression; more oaks became established and Douglas-fir is prevalent in the overstory and understory. These factors have resulted in the decline of oak tree vigor and acorn production.

The conifer forests and their various stages of development are also influenced by numerous ecological and physical processes. Coarse woody material (CWM) appears to be the heart of numerous ecosystem processes and it is a vital part of forest productivity. CWM is defined as fallen trees and tree pieces, fallen branches larger than 1 inch in diameter, dead roots, and standing dead trees. As a general rule, CWM decreases from high to low elevations. West and south aspects have smaller amounts also because of drier conditions. In the lower elevations, CWM is usually less than 10 tons per acre. The more moist, higher elevations have approximately 13 to 20 tons of CWM per acre (Soda Mountain/Camp Creek and Skookum Creek, in the adjacent Jenny Creek Watershed, areas respectively) (USDI 1998). The more moist sites have larger diameter trees so amounts of CWM tend to be greater.

In the historic forests, bark beetles and pathogens were probably more benign due to low tree stocking levels. The present day overstocked forests have allowed for a decline in forest growth and vigor resulting in the dramatic increase of bark beetle populations and increasing tree mortality. The various bark beetles throughout the watershed that are causing extensive tree mortality on the drier sites are moving the forest stands to a more open condition. Where the Douglas-fir trees are dying adjacent to shrublands and woodlands and on dry ridge-tops, there is an opportunity to reestablish drought tolerant species such as ponderosa pine and incense cedar. Root rot diseases, especially in the higher elevation white fir areas, are also functioning in the same manner. Forest stands that were predominantly Douglas-fir, pine species, and incense cedar historically and are now predominantly true fir species, are reverting back to the early seral species. Where white fir is dying because of laminated root rot, disease tolerant pine species and incense cedar can once again be reintroduced. Dwarf mistletoe species are also causing tree mortality on a small scale.

As forest stands increase in age, there is a higher probability of some type of disturbance. Since many of the predominant, mature second growth forest stands in the watershed are over 100 years of age, they are currently more susceptible to disturbance. Some stands are still in the stem exclusion stage of development, but many stands are entering the understory reinitiation stage because of the ecological processes discussed (Oliver and Larson 1990). These processes are also part of the formation of late-successional forests by creating multi-cohort, multi-storied forests. Wind damage is another important process in mature forests for creating openings and the reintroduction of a new forest age class and seedlings of the desired species.

These various ecosystem processes must be monitored carefully if fire suppression across the landscape continues. Natural vegetation succession may not be desired everywhere. Without large openings in forest stands, shade tolerant species such as true fir species and Douglas-fir will predominate most forest stands, and early seral species will continue to decline. Silvicultural treatments will be necessary to maintain and manipulate the structure and species

composition of the forest stands if fire does not. Reduction of vegetation stocking levels is also needed if individual tree and forest vigor is to be maintained.

In summary a few conclusions are apparent:

1. Forests in the lower elevations where rainfall is less than 30 inches annually should not be expected to develop into large continuous matrix areas of dense, lush late-successional forests. These dry, low elevation forests must be maintained at lower stocking levels with drought resistant species predominating. Openings are essential for maintaining the drought resistant early seral species. If the stocking levels of the vegetation are not managed, physical and ecological processes will continue to naturally thin the vegetation and the species composition of the early seral species may continue to decline.

2. It must be recognized that mature, overstocked forest stands across the landscape are being observed at one point in time. Numerous processes will continue to affect the forest stands' stocking levels and structure. As small scale, physical and ecological processes continue to create openings in the present day forest stands, more diverse stand structure will develop over time. With these processes and silvicultural treatments to control stocking levels, the potential exists for more forests with late-successional characteristics in the future.

3. Without vegetation stocking level management or low intensity fire, individual shrub and tree vigor will remain low and high levels of vegetation mortality may occur. Large stand replacement fires are also probable without stocking level management. Grasslands will continue to decrease in size, and open, parklike oak woodlands will disappear.

FIRE AND AIR QUALITY

Historically, frequent, low intensity fires maintained most valley bottomlands and foothills as grasslands or open savannas. Forests fashioned from frequent, low intensity fires have been described as open and parklike, uneven-aged stands, characterized by a mosaic of even-aged groups. Douglas-fir, ponderosa pine, sugar pine, and white fir were the most common species. Depending on understory vegetation conditions these species have some resistance to fire as mature trees. As saplings, ponderosa pine is the most resistant followed by sugar pine, Douglas-fir, and white fir. Frequent fires had major structural effects on young trees favoring ponderosa pine as a dominant species and white fir as the least dominant in this forest type.

Fire suppression over the past century has effectively eliminated five fire cycles in southwest Oregon mixed conifer forests (Thomas and Agee 1986). The absence of fire has converted open savannas and grasslands to woodlands and initiated the recruitment of conifers. Oregon white oak is now a declining species largely due to fire suppression and its replacement by Douglas-fir on most sites.

Fire-intolerant, shade-tolerant conifers have increased and species such as ponderosa pine and sugar pine have declined. This conversion from pine to true fir has created stands that are

subject to stress, making them susceptible to accelerated insect and disease problems (Williams et al. 1980).

The horizontal and vertical structure of the forest has also changed. Surface fuels and the laddering effect of fuels have increased and this increases the threat of crown fires, which were historically rare (Lotan et al. 1981). Fire exclusion has caused a shift from low-severity fire regimes to a high severity regimes. This is characterized by infrequent high intensity, stand replacement fires. Fire is now an agent of ecosystem instability as it creates major shifts in forest structure and function on a large scale.

In summary, the fire hazard for this watershed has increased over time. Focus of fire hazard reduction projects on the low severity fire regime areas can help restore these areas. Further changes in how wildfire is managed across the landscape may be needed for maintenance. These changes may include management of wildfire for resource benefit as opposed to the current direction for full suppression. However, full suppression strategy will always be a major part of fire management within this watershed due to the top priorities of protecting life, resources and property.

Air quality can be adversely effected by prescribed burning and wildfires. Prescribed burning conducted in compliance with federal, state, and local smoke management regulations should minimize adverse effects to populated areas. Furthermore, specific burning and mop-up strategies and tactics can be employed to reduce emissions. Fire hazard reduction projects, over time, should affect the long-term emissions from wildfires within the watershed. This effect should be a reduction of emissions as lighter fuel loads are consumed as the fire intensities over time are reduced through fuels management.

TERRESTRIAL WILDLIFE SPECIES AND HABITATS

Wildlife - General

Vegetative conditions are the primary influence on terrestrial wildlife/animal populations and their distribution within the watershed and across the greater landscape. A variety of processes have changed the vegetation within the Klamath-Iron Gate Watershed over time. These include natural and human-caused disturbances and natural succession. Current conditions of the watershed differ from reference conditions primarily due to human-caused disturbances such as timber harvest, agriculture, fire suppression, introduction of exotic plant species, and residential development.

A direct comparison of the acreage of current and reference vegetative conditions is not possible. Some generalizations, however, can be made based on some of the processes known to have taken place in the watershed. Mature/old-growth habitat has declined, particularly in the northeast portion of the watershed where intensive timber harvest has occurred. Therefore, it can be assumed that populations of those wildlife species preferring the structure and conditions provided by this habitat type have also declined.

The quality of the mid-seral conifer habitat has declined primarily as a result of fire suppression. Historically, much of this habitat was characterized by more open canopies (as a result of fire) and a healthy herbaceous and shrub component. This combination provided habitat for quite an array of species. Due to fire suppression, however, many of the mid-seral stands now are single-storied with a high degree of canopy closure and virtually no understory vegetation. In comparing wildlife use of dense-canopied single-storied stands to more open multiple-storied stands, data in Brown (1985) suggest that approximately twice as many vertebrate wildlife species use the multiple-storied stands.

Much of the early seral conifer habitat (grass-forb, shrub and sapling/pole) is present as a result of timber harvest. Consequently, snags and large down woody material are deficient in these habitats, and this condition will persist as these stands mature. Thus, populations of those species requiring or preferring snags and large down woody material have likely declined, and will remain suppressed until there is recruitment of these habitat features as a result of ecological processes.

The absence of fire has allowed much of the oak and oak/pine woodlands to become over-dense, and has also allowed conifer and shrub encroachment at nonhistoric levels. The result is increased mortality, reduced growth, and diminished mast (acorn) production, particularly in the larger oaks. Because the large oaks provide both natural cavities and generally good acorn crops, they are important to a variety of wildlife species. Populations of those species that depend on these features of the oak and oak/pine woodlands have probably declined.

Like oak-savannah habitat, the quality of shrubland habitat has also declined due to fire suppression. Fire is the primary process for early seral development in this plant community. In the absence of fire, much of the habitat has matured and early seral conditions are deficient. As a result, the most critical forage for overwintering deer is being lost.

Much of the low elevation riparian habitat has been removed for agricultural, development, and hydroelectric purposes. Also, the higher elevation riparian areas and meadows have been degraded by logging. Grazing has also degraded riparian habitat in some portions of the watershed. However, riparian habitat in the mid and upper reaches of Scotch, Dutch Oven and Camp Creeks seem to be in relatively good condition.

The quality and quantity of native grass/forb/herbaceous habitat in meadows and grasslands throughout the watershed have declined dramatically due to the invasion of noxious weeds, the planting of non-native grasses, and the encroachment of shrubs and conifers. Practically all nonagricultural grasslands in the lower elevations of the watershed are now fields of noxious weeds and grasses (e.g., yellow star thistle and cheatgrass). The introduction of other non-native grasses has generally occurred as a result of well-meaning projects, but nevertheless has resulted in the decline of native grasses. Encroachment of trees and shrubs have primarily been the result of fire exclusion over the past century. This decline in quality and quantity of habitat has had an adverse impact on herbivores in the watershed.

Threatened/Endangered Species

Northern spotted owls seem to be highly associated with mature/old-growth forest habitat. A decrease in this habitat from historic to present levels as a result of logging is apparent. Due to the decrease in suitable habitat, it is reasonable to assume that northern spotted owl populations are now lower than in the past. The current population could remain stable, but is more likely to continue to decline. Two of the known sites are located in areas designated for special management, and these sites should persist. The two other existing sites, however, are in the matrix land allocation, and future timber harvest could eliminate these sites.

Bald eagles undoubtedly foraged along the Klamath River before Euro-American contact, and probably nested in the watershed as well. Bald eagles still forage along the non-reservoir portions of the Klamath River, and Iron Gate Reservoir now also provides an important foraging area. Foraging activity will probably remain at or near present levels, and if suitable nest structures are available, bald eagles will likely nest in the watershed sometime again in the future.

Northern Spotted Owl Critical Habitat

Northern spotted owl critical habitat was not designated until 1992. Prior to that time, the area within the watershed that is now critical habitat was under varying management treatments, e.g., commercial forest land and Wilderness Study Area. The management emphasis in the area designated as critical habitat was to maintain and improve nesting, roosting, foraging and dispersal habitat in the southern portion of the I-5 area of concern. However, with the adoption of the Northwest Forest Plan in 1994, the apparent primary function of critical habitat that is not included in Late-Successional Reserves (LSRs) is to help provide for spotted owl dispersal/connectivity between the mapped LSRs. None of the critical habitat within the analysis area is in an LSR, although some of it is within other special management areas in the watershed. The function of the existing nesting, roosting, foraging and dispersal habitat in these areas will probably continue until natural processes change the function.

Special Status Species

The widespread decrease in mature/old-growth habitat via timber harvest is responsible for the listing of many of the special status species found in the watershed. These species prefer mature/old-growth mixed conifer forest for feeding, breeding, and/or sheltering. As in other areas, the decrease in late-successional habitat in this watershed has likely caused a decrease in the populations of those special status species preferring late-successional habitat. It is not expected that these species will be extirpated from the watershed, but recovery of these populations to prehistoric levels is not anticipated since timber harvest on private and public land is expected to continue.

Some species have received special status designation due to factors other than the reduction of late-successional forest habitat. As an example, a contributing factor for designation of the western pond turtle is predation by the bullfrog, an introduced species. As with the special

status species designated as a result of late-successional habitat loss, extirpation of other special status species in the watershed is not anticipated, but neither is recovery since the human-caused processes that contributed to their designation will likely continue.

Other species are designated as special status because there is a lack of information about them. As these data gaps are filled, it is possible these species could be removed from the special status species list.

Survey and Manage, and Protection Buffer Species

All survey and manage and protection buffer species known or suspected to be present in the watershed (see Current Conditions) are believed to be associated with and prefer mature/old-growth habitat conditions. Great gray owls use this habitat for nesting, but forage in meadows, agricultural land, and the early seral stages of mixed conifer forests. It is unknown how management in the watershed has affected overall habitat for the great gray owls. Populations of the various bat species listed in the Northwest Forest Plan have likely declined as many are linked with the bark fissures of old-growth and the snag component of these stands. With so little understood about actual habitat requirements of many of the mollusc species, it is unknown how the change in vegetation patterns from reference to current conditions has affected these species. The watershed is probably not in the range of the red tree vole or the Survey and Manage salamander species.

Black-Tailed Deer

The primary concern for the Jenny Creek Interstate Deer Herd is the deteriorating forage conditions on the winter range. Good forage conditions on winter ranges are obviously important for winter survival. Before the historic period, winter forage was probably not a limiting factor for the Jenny Creek Interstate Deer Herd because native burning maintained good forage conditions. However, as discussed in the Current Conditions section, winter forage conditions in the watershed are currently poor due to the lack of regeneration in the mountain shrubland plant community and the encroachment of noxious grasses and forbs into the native grass-forb community. The poor forage condition may limit the size of the interstate deer herd, and as forage conditions worsen, the population will decrease. Conversely, if forage conditions are improved, herd size should increase, assuming summer range conditions remain stable.

HYDROLOGY

Human uses occurring after Euro-American settlement have had the most influence on the hydrologic processes in the Klamath-Iron Gate Watershed. Human influences having the potential to adversely affect the timing and magnitude of both peak and low streamflows in the watershed include road construction, timber harvest, land clearing, dams, and water withdrawals.

Potential effects due to peak flows may include channel widening, bank erosion, channel

scouring, landslides, and increased sediment loads. These are normal occurrences in a dynamic, properly functioning stream system; however, increases in the magnitude and frequency of peak flows due to human-caused factors can magnify the effects.

Effects of high road densities on hydrologic processes are a concern in Fall Creek and the headwaters of East Fork Camp and Dutch Oven creeks. Permanent road systems intercept surface runoff and subsurface flow, which prevents the streamflow regime from returning to pre-disturbance levels.

Current levels of timber harvest and land clearing in the western portion of the watershed have a low potential for increasing the magnitude and frequency of peak flows. However, recent logging and road building in the Fall Creek Subwatershed could contribute to increased frequency and magnitude of peak flows. Openings in the transient snow zone are not a significant concern in the watershed based on the 1997 Landsat data, but with the high level of recent timber harvest in Fall Creek, it could become a concern.

The dams on the Klamath River have altered the river's flow regime by moderating high flows resulting in fewer and smaller peak flows. This has affected the sediment transport regime by reducing the amount of bedload material that is moved downstream, thus causing a shortage of spawning gravels.

Low summer flows are primarily due to natural conditions; water withdrawals are a concern in the lower reaches of tributaries to Iron Gate Reservoir. The largest water diversions are from the lower reach of Fall Creek for hydroelectric power and municipal water supply (City of Yreka). Water from Fall Creek and Scotch Creeks is also used for irrigation. Diversions from Spring Creek in the Jenny Creek Watershed contribute to increased summer flows in Fall Creek.

STREAM CHANNEL

Channel conditions in the Klamath-Iron Gate Watershed have changed since Euro-American settlers arrived in the 1830s. Initially, there was a reduction in the amount of woody material in the streams due to beaver trapping in the 1830s to 1840s. The loss of beaver dams resulted in scoured channel beds and banks, reduced number of stream reaches with multiple channels, increased width/depth ratios, and increased fine sediment deposition in pools. These changes were accompanied by decreased sinuosity, increased stream gradients and reduced bedload transport capability. In general, the stream channel complexity was reduced.

As more settlers arrived, logging in the uplands and riparian areas, livestock grazing, and road building resulted in decreased bank stability and further reduced the amount of woody material. Removal of riparian vegetation has had a detrimental affect on channel stability and the presence of large woody material in the stream channels. Stream reaches lacking riparian vegetation are more susceptible to streambank erosion during peak flow events. This is especially true in the valley bottoms, where large volumes of water during flood events can erode massive amounts of streambank material. There is a minimal amount of large woody

material in stream channels; many reaches lack the potential for short-term future recruitment. Large woody material is essential for reducing stream velocities during peak flows and for trapping and slowing the movement of sediment and organic matter through the stream system. It also provides diverse aquatic habitat. Riparian Reserves along intermittent, perennial nonfish-bearing and fish-bearing streams will eventually provide a long-term source of large wood recruitment for streams on federal land.

Over the last decade there has been less logging and road development in the headwaters of Camp and Scotch Creeks, but erosion and sediment deposition is still ongoing, especially in the East Fork Camp Creek where timber harvest occurred on private and federal lands within the last twenty years. A BLM thermograph installed in this stream was buried in sediment over the course of a summer in which there were electrical storm events. Recent logging and road building on private land in the headwaters of Fall Creek has already resulted in channel stability problems in seasonal streams.

Even after logged areas are re-planted and stabilized, roads continue to supply sediment to streams above natural levels as long as they exist. Road stabilization, maintenance (including drainage improvements), and decommissioning would reduce the amount of sediment moving from the roads to the streams. Roads constructed adjacent to stream channels tend to confine the stream and restrict the natural tendency of streams to move laterally. This can lead to down cutting of the stream bed and bank erosion. Obliteration of streamside roads would improve the situation.

The level of livestock grazing in these watersheds is much reduced from the magnitude in the late 1800s and early 1900s. Grazing activities on public lands are monitored closely by BLM range specialists. A recent stream survey of Camp Creek, however, noted bank disturbances by livestock. Adjustments in grazing prescriptions may be necessary to correct this problem.

Recreational use of unsurfaced roads is also a cause of sediment in streams, especially use after the fall rains have begun. Members of the public, including hunters and off-road enthusiasts, unwittingly, or knowingly, annually cause damage to roads which results in gullying and subsequently, sediment and turbidity in streams.

Many private lands in the analysis area are accessed over roads that are unsurfaced, or inadequately surfaced to prevent runoff of sediment into nearby streams. Improvements in road surfacing and drainage would reduce the problem.

WATER QUALITY

Human use is the principle cause of changes in water quality from reference to current conditions in the Klamath-Iron Gate Watershed. Water quality parameters known to be affected by human disturbances are temperature, sediment, and turbidity in the tributaries to Iron Gate Reservoir and temperature, dissolved oxygen, and nutrients in the Klamath River and Iron Gate Reservoir. Riparian vegetation removal and roads are the primary factors that have adversely affected water quality in the Iron Gate Reservoir tributaries. Water quality

concerns in the Klamath River are attributed to dam construction/operation, flow regulations/modification, water diversions, habitat modification, nonpoint sources, municipal point sources, irrigated crop production, and agricultural return flows (California Environmental Protection Agency 1998).

Summer water temperatures for the East and West Forks of Camp Creek exceeded the Oregon temperature criteria during the summer of 1998, but not during 1997. Additional monitoring is necessary to determine if these streams should be added to Oregon's water quality limited streams. No stream temperature data is available for Scotch or Fall Creeks. Maintaining adequate shade along perennial streams is the best protection measure for preventing human-caused increases in stream temperature.

Roads, timber harvest, and riparian vegetation removal are the primary cause of stream sedimentation in the Klamath-Iron Gate Watershed. Road drainage improvements, maintenance, and decommissioning would decrease sedimentation and turbidity in Scotch, Camp, and Fall Creeks. Restricting OHV use to the dry season would also help reduce the amount of road-related erosion. Reducing the amount of tractor logging and leaving adequate riparian buffers would also decrease stream sedimentation. Concentrated livestock grazing near streams that contributes to increased levels of sediment can be corrected through proper livestock management strategies.

RIPARIAN AREAS

The natural and human-caused events that have altered stream channels and water quality have affected riparian habitat as well. Natural occurrences including major flood events, landslides, wind, fire, insects, pathogens, animal damage, and plant succession have altered the pattern and structure of the riparian vegetation in the analysis area. Over time these disturbances have created new habitat, altered existing habitat, and destroyed old habitat for vegetation and aquatic and terrestrial wildlife.

Human-caused disturbances, including road construction, timber harvesting, agricultural, rural development, irrigation and hydro-electric developments, and livestock grazing have impacted riparian and aquatic habitat. Some of the results are fragmented connectivity of riparian habitat; reduced quantity of snags and large woody material; reduced streambank stability; increased sediment production to streams; and reduced stream shading with an added impact of higher stream temperature. Continuation of these disturbances will delay restoration of stable banks, riparian vegetation and proper functioning condition of stream channels and floodplains.

AQUATIC WILDLIFE SPECIES AND HABITATS

Since the construction of Iron Gate Dam on the Klamath River, anadromous fish no longer have access to the river above that point or to upstream tributaries. The reservoir behind the dam supports populations of non-native warm-water fish and trout. Trout that have become

established in the impoundment have access to lower reaches of Scotch, Camp and Fall Creeks below barriers where they may be competing with native trout for food and space, and cross-breeding with native fish with the consequence of an altered gene pool in surviving fish.

The 1997 ODFW stream survey of Camp Creek noted significant numbers of resident trout throughout the surveyed reaches. This information is encouraging, but the survey report also described stream conditions that amount to marginal to poor habitat that are well below their potential for trout production. Many stream reaches were scoured to bedrock. Pools were few and lacking desired depth for suitable cover. Woody debris was sparse and much of the substrate was compacted with sediment. The survey report sends a clear message that there is considerable opportunity to improve habitat for fish and other aquatic resources on private and federal lands.

The genetic integrity of native trout is also an issue in upper Fall Creek which receives water, and trout, from Spring Creek in the Jenny Creek Watershed. This concern for genetic integrity transcends in reverse direction back to Spring Creek which may also have trout with altered genetic makeup due to intrusion of Fall Creek fish. In addition to the concern for trout, snails of the genus *Juga* have moved from Spring Creek into the Fall Creek drainage and are well established in that stream system.

Stream survey data for Dutch Oven Creek and macroinvertebrate sampling done by Wisseman (1993) indicates an abundance of aquatic insects in that stream. Elsewhere in the Camp Creek Subwatershed, it is evident that production of aquatic organisms is less than the potential in stream reaches that are scoured to bedrock and others where substrate material is compacted by sediment. No amphibians, including Pacific giant salamander, have been reported in Camp Creek. Regionally, this species is common in more stable watersheds.

MANAGEMENT OBJECTIVES AND RECOMMENDATIONS FOR BLM-ADMINISTERED LANDS

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
HUMAN USES			
Economic Development	Encourage opportunities for local contractors to compete effectively on contracts for projects in the watershed.	1. Promote small-scale projects in forest, range, riparian, and other resources suitable for local administration and contractors.	High
	Maintain opportunities in agricultural sector to provide economic stability of local communities.	1. Where possible, maintain opportunities for local grazing on public lands subject to the appropriate BLM guidelines and planning documents.	High
	Produce a sustainable timber supply and other forest commodities on Matrix lands to provide jobs and contribute to community stability.	1. Conduct timber harvest and other silvicultural activities on suitable Matrix forest lands where there is no conflict with special area objectives.	High
Public Involvement	Maintain and promote contacts with local groups, landowners, community leaders, tribal and public agencies to facilitate continuing dialogue on the management of public lands in the Klamath-Iron Gate Watershed.	1. Maintain and expand contacts with local groups. 2. Promote interagency coordination between the BLM Redding Field Office and California Fish and Game for management of the Horseshoe Ranch Wildlife Area.	High High
	Provide opportunities for public and private entities to exchange information and develop consensus concerning land management actions within the watershed, and to enhance awareness of local public concerns and issues affecting management of the watershed's ecosystem.	1. Utilize local avenues of communication, such as local newspapers, newsletters, and bulletin boards; utilize local meeting spots for informal meetings with residents. 2. Identify and incorporate tribal representation into all public involvement, and keep them informed of land management activities in the watershed.	High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Archaeology	Assess archaeological sites to determine their scientific and heritage values and protect or recover those values as necessary.	1. Work through partnerships with local groups to promote appreciation and understanding of the watershed's cultural resources. 2. Define the types of historic and American Indian archaeological sites that are likely to occur within the watershed. 3. Encourage archaeological/historical site protection and stewardship among the public through heritage education practices.	High Medium Medium
	Conserve and protect archaeological/historical sites within the watershed.	1. Use careful land use planning to avoid impacts to these resources. 2. Monitor resources to control threats (such as erosion, vandalism) to them.	High Medium
	Consider the concerns of Native American groups regarding cultural resources, including traditional cultural properties, within the watershed.	1. Consult concerned Native American groups early in the planning stages of any project in the watershed.	High
Transportation	Manage the transportation system to serve the needs of the users and meet the needs identified under other resource programs.	1. Implement the Transportation Management Plan (TMP). 2. Implement Transportation Management Objectives (TMOs) for individual roads. a. Maintain the road closure system. b. Maintain all roads for the target vehicles and users. c. Provide for initial fire suppression access. d. Maintain a safe transportation system by removing hazards (e.g., hazard trees).	High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Transportation	Maintain a transportation system (including trails, landings and skid roads) that meets the Aquatic Conservation Strategy and Riparian Reserve objectives.	1. Implement the Northwest Forest Plan Standards and Guidelines for Roads Management (USDA and USDI 1994a, pages C-32 and C-33).	High
		2. Follow the Best Management Practices for Roads in the Medford District Resource Management Plan (USDI 1995a, pages 155-165).	High
		3. Assess all roads, especially in Riparian Reserves, and identify those in unstable and slide-prone areas, those with potential erosion/drainage problems, and those that are encroaching on a stream channel. Update the TMOs based on the findings.	High
		4. Develop and implement plans for decommissioning, obliteration, upgrading (i.e., improve drainage, surface and stabilize) or rerouting the roads identified in recommendation #3 to protect Riparian Reserves, stream channels and water quality and meet TMOs. Replant obliterated road corridors to native tree and other native plant species.	High
		5. Prioritize watershed restoration projects for roads in Riparian Reserves and areas where roads accelerate landslides and erosion, especially where they contribute large amounts of sediment to streams.	High
		6. Minimize soil compaction due to existing roads or skid trails in meadows and wetlands by decommissioning or obliterating roads and ripping skid trails. Where it is not feasible to close these roads, they should be improved to restrict traffic to the road prism.	High
		7. Close natural surface roads during the wet season.	High
		8. Maintain a minimum of four inches of rock surfacing on all BLM-maintained roads open for administrative access during the wet season.	High
		9. Provide vegetative cover (native grass and conifers) on natural surface roads that are closed year-round.	High
		10. Ensure that road stream crossings and cross drains are functioning as designed, especially following major storm events. Replace culverts that are improperly designed.	High
		11. Minimize any increases in road mileage.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Transportation	Maintain a transportation system (including trails, landings and skid roads) that meets the Aquatic Conservation Strategy and Riparian Reserve objectives.	(continued) 12. Use an interdisciplinary team to perform a project level, site-specific analysis for any proposed road construction. Avoid new road construction or landings within Riparian Reserves, wetlands, and unstable areas unless approved by an interdisciplinary team that includes a fisheries biologist, hydrologist, and soil scientist. 13. Maintain a natural stream bed for fish passage wherever feasible and economical. 14. Identify skid roads and landings that are not critical for future management activities and decommission or obliterate them. Skid roads and landings in Riparian Reserves or unstable areas should be the highest priority for removal.	High High High
	Maintain a transportation system that meets the objectives of the Cascade/Siskiyou Ecological Emphasis Area (CSEEA) Management Plan.	1. Implement the recommendations identified in the CSEEA Management Plan when it is completed.	High
	Maintain or enhance current native terrestrial wildlife populations and distribution.	1. Close roads during critical periods (generally November 15 to April 15) in subwatersheds where densities are greater than 1.5 miles per square mile of land. 2. Close roads that are not needed for administrative access or management activities.	High High
	Restore land that has been taken out of production.	1. Consider decommissioning or obliterating roads based on TMOs in order to put land back into plant production.	Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Transportation Schoheim Road (Preferred alternative(s) to be determined by the Cascade/Siskiyou Ecological Emphasis Management Plan)	Alternative A. Manage the Schoheim road system (including connector spurs) to provide administrative and fire access and motorized recreation while minimizing sedimentation, hydrologic disruptions, and wildlife disturbance. The long-range objective is for the road to evolve to limited vehicle access with minimal drainage maintenance.	1. Maintain the Schoheim road system within the watershed to reduce sediment and erosion problems. Primary emphasis would be to provide for proper drainage and to prevent vehicle access (except snowmobiles) during the wet season when road damage may occur (normally between October 15 and June 15). Improve drainage facilities and stabilize areas where increase sedimentation may occur on the portion that cannot be physically blocked.	High
	Alternative B. Maintain and enhance natural ecosystems by helping to prevent the spread of noxious/alien weeds (starthistle, dyers woad, and spotted knapweed) and pathogens (black stain) by motorized vehicles.	1. Convert the portion of the Schoheim road within the Klamath-Iron Gate Watershed to a nonmotorized, hiking/horse trail on the existing road prism.	High
	Alternative C. Provide biological connectivity and passage for aquatic organisms within the Klamath-Iron Gate Watershed.	1. Convert the portion of the Schoheim road within the Klamath-Iron Gate Watershed to a nonmotorized, hiking/horse trail on the existing road prism. 2. Remove culverts at major stream crossings and recontour stream crossings to pre-road cross section to allow the natural downstream movement of erosional materials and woody debris and eliminate the dam effect at the crossing. 3. Construct stream crossing for pedestrian and equestrian traffic.	High High High
	Alternative D. Prevent habitat fragmentation of large roadless area.	1. Convert the portion of the Schoheim road within the Klamath-Iron Gate Watershed to a nonmotorized, hiking/horse trail on the existing road prism.	High
	Alternative E. Improve the biological integrity and decrease the possibility of future wildlife harassment by poachers and animal vandals.	1. Convert the portion of the Schoheim road within the Klamath-Iron Gate Watershed to a nonmotorized, hiking/horse trail on the existing road prism.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Road Rights-of-way	Cooperate with individuals, companies, counties, the state, and federal agencies to achieve consistency in road location, design, use, and maintenance.	1. Maintain and implement reciprocal road right-of-way agreements. 2. Implement road use and maintenance agreements. 3. Evaluate and provide road right-of-way grants. 4. Obtain road easements for public and resource management needs. 5. Work with other parties to stabilize roads and remove unneeded roads.	High High High High High
Other Rights-of-way and Authorizations	Coordinate with individuals, companies, nonprofit groups, counties, state, and other federal agencies on all inquiries/applications for non-road rights-of-way, leases, permits, and exchanges on BLM-managed lands.	1. Review each request on its own merits. 2. Respond to all requests in a timely manner. 3. Ensure consistency, fairness, and legal/environmental compliance in all decisions. 4. Monitor implementation of rights-of-ways and authorizations.	High High High High
Grazing	Manage livestock in a manner that maintains or improves Riparian Reserves to meet the goals of the Aquatic Conservation Strategy.	1. Stress the importance of properly functioning riparian areas in the issuance of grazing authorizations. 2. Implement Medford and Redding Resource Management Plans to ensure movement toward land use objectives.	High High
	Continue to provide livestock forage on designated allotments to meet societal needs, without compromising the ecological integrity of the uplands.	1. Develop management strategies in consultation with the permittee to resolve resource conflicts that arise. 2. Update allotment plans as needed. 3. Control noxious weeds. 4. Maintain a list of vacant allotments, including specific management constraints and concerns, for future inquiries.	High High High Medium
Wild Horses	Manage the Pokegama wild horse herd for a viable population. (Coordinate with Klamath Falls Resource Area which has the lead for the herd area).	1. Ensure the protection and management of the Pokegama wild horse herd. 2. Provide adequate forage and water to sustain a healthy population. 3. Remove animals as necessary when populations exceed prescribed management levels.	High High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Minerals	Continue to coordinate with individuals, companies, counties, state, and other federal agencies on all inquiries/applications for mineral exploration and development.	1. Respond to all inquiries/applications in a timely manner.	High
	Rehabilitate disturbed areas due to past mineral activity. On disturbed sites, ensure public safety and enhance other resources values such as riparian or fisheries habitat.	1. Evaluate and prioritize known disturbed areas for rehabilitation. 2. Develop rehabilitation plans including a budget for targeted areas. Do this through an interdisciplinary effort. 3. Implement plans in a timely manner.	Low Low Low
	Provide for federal and public use of mineral resources consistent with National Environmental Policy Act (NEPA) requirements and mining laws.	1. Monitor pit development use during extraction. 2. Coordinate with local watershed councils and state agencies in developing new rock sources in the watershed. 3. Prepare, or where existing, update long-term rock quarry management plans to ensure quality rock material is economically available for the future. 4. Develop mineral sources as necessary for public use.	High Medium Low Low
	Reduce sediments and pollutants from rock quarries.	1. Avoid developing rock quarries in or adjacent to Riparian Reserves. 2. Rehabilitate abandoned rock sources to reduce sediments and pollutants.	High Medium
Recreation	Maintain dispersed recreational opportunities. Utilize public input for planning purposes.	1 Continue to encourage dispersed recreational opportunities that are compatible with other resource values within the watershed. 2. Implement off-highway vehicle designations contained in the Medford Resource Management Plan. 3. Continue to manage the Pacific Crest National Scenic Trail according to the comprehensive management plan and the Medford District's management plan for the Trail. 4. Continue to monitor the Soda Mountain Wilderness Study Area according to the interim management policy.	High High High High
	Recreate an historic cabin and provide a shelter for users of the Pacific Crest National Scenic Trail.	1. Rebuild the Bean Cabin in the meadow where it once stood.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Unauthorized Use	Minimize and/or reduce unauthorized use including dumping on BLM-managed lands.	1. Continue coordination with state/county agencies to ensure that resource needs on adjacent public lands are considered and accommodated in private actions. Utilize law enforcement resources when appropriate. 2. Review and prioritize backlog cases and take steps to resolve in a timely manner.	High Medium
EROSION PROCESSES			
Erosion	Protect unstable areas.	1. Inventory all BLM-administered lands to identify active landslides and prioritize potential restoration projects. 2. Stabilize actively eroding landslide areas that are contributing sediment to streams	Medium Medium
SOIL PRODUCTIVITY			
Soil Productivity	Minimize the effects of fire to the soil.	1. Implement cool prescribed burns to maintain 50 percent duff and litter on site. Consider aspect, slope steepness, soil depth, and duff/litter cover when writing burn plans.	High
	Minimize soil productivity losses due to compaction.	1. Limit tractor skid roads to less than 12 percent of the harvest area with less than 6 percent loss in soil productivity. 2. Accomplish skidding during the time of the year when soil moisture levels are low (less than 15 percent) in areas with fine-textured soils and high rock content where mitigation efforts are difficult. Skidding could be accomplished during the winter when a minimum 12 inch snowpack exists and temperatures are below freezing the entire day.	High High
	Minimize loss of topsoil.	2. Maintain a vegetative cover on the soil across the landscape throughout most of the year. 3. Minimize and mitigate bare soil areas caused by logging, road building, burning, and overgrazing.	High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
PLANT SPECIES AND HABITAT			
Non-Native Plant Species and Noxious Weeds	Prevent or discourage the spread of non-native plant species and noxious weeds. Prevent or discourage any increase in abundance of these species where they currently exist in the watershed.	1. Emphasize prevention activities: a. Minimize ground disturbing activities in the watershed. 2. Use native species from local gene pools when plant materials are needed for project use. If the native species are unavailable or unsatisfactory, use non-invasive or non-persistent non-native species. c. Clean vehicles and equipment after being in known noxious weed infestation areas.	High
		2. Use integrated pest management and appropriate research recommendations for control and/or eradication of noxious weeds. See Vegetation recommendations.	High
		3. Continue use of Best Available Technologies (BATs) and practices outlined in BLM planning documents.	High
		4. Continue cooperation with Oregon Department of Agriculture for species identification and tracking.	High
		5. Promote cooperation with local landowners and other government agencies.	High
		6. Use grazing systems and best management practices designed to encourage native grasses and discourage non-native annual grasses on upland ranges.	High
		7. Increase public awareness of noxious weed species and their management.	High
		8. Consider the use of sterile and/or adapted competitive grasses on disturbed sites to prevent the encroachment of noxious weed species, especially on low elevation sites. These grasses should improve nutrient cycling and reduce noxious weed seeds in the soil. As appropriate, convert these sites to native species.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Special Status Plant Species and Habitats	Manage special status plant species and their habitats so as not to contribute to the need to list as threatened or endangered with the U. S. Fish and Wildlife Service.	1. Mitigate impacts of management activities to special status plants.	High
		2. Monitor impacts of management activities and effectiveness of mitigation measures on special status plants.	High
		3. Survey the entire watershed for special status plant occurrence.	Medium
		4. Develop and implement conservation strategies for Federal listed, candidate, and Bureau sensitive plant species.	Medium
		5. Work with other agencies, universities, and private groups on monitoring and research projects for special status plants.	Medium
	Maintain and enhance special status plant populations, habitats, distribution and viability.	1. Identify and map potential habitat for special status plants found in the watershed.	Medium
		2. Identify important habitat characteristics of special status plants found in the watershed and design management activities that will duplicate these characteristics.	Medium
		3. Monitor special status plant populations to gain data on biology, phenology, demography, and ecology.	Medium
	Preserve, protect, and restore species composition and ecological processes of natural plant communities.	1. Control noxious weeds and other exotic species.	High
		2. Develop a sustainable and economical local native seed source for future reseeding efforts.	High
		3. Use, when available, native species for all vegetation and revegetation projects.	High
		4. Avoid the use of native species from non-local sources that may be a threat to local genetic diversity.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Survey and Manage Plant Species and Habitats	Maintain and enhance survey and manage populations, habitats, distribution and viability.	1. Implement survey protocols and management recommendations as they are developed. 2. Maintain adequate down coarse woody material, an important habitat component for survey and manage fungi and bryophytes. 3. Maintain the Abies component of the large diameter forests as habitat for rare cup fungi. 4. Minimize soil compaction and humus layer disturbance, important site characteristics for survey and manage fungi. 5. Monitor known sites to assess compliance with management guidelines and evaluate impacts of management actions. 6. Monitor populations of survey and manage species to address identified data gaps.	High High High High High Medium
VEGETATION			
Seedlings through Poles, Large Poles, Mature, and Late-Successional Vegetation Classes	Improve forest stand health by increasing growth, quality, and vigor of individual trees. This objective is the most critical for preventing mortality of additional trees.	1. Reduce timber stand densities when the stands have a relative density index of 0.55 or greater by using appropriate silvicultural prescriptions to decrease the number of trees per acre (or basal area), to a relative density index of approximately 0.30 to 0.40. 2. Manage for species composition by aspect (pine on south and west aspects; Douglas-fir on east and north, etc.). 3. Use pruning as an option for improving wood quality in fast-growing pole stands.	High High Low

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Seedlings through Poles, Large Poles, Mature, and Late-Successional Vegetation Classes	Design and develop a diverse landscape pattern and contiguous areas of multi-layered, late-successional forest (timber stands with diversified stand structure in regard to tree height, age, diameter classes, and species composition through uneven-aged management) over time. To meet the retention requirement on federal forest lands, no less than 15 percent would be in a late-successional class (see Appendix I and Map 21). Additional late-successional stands will be present outside of Riparian Reserves and areas of connectivity, most likely as isolated pockets of refugia. The remainder of the forest lands would be in earlier stages of seral development.	1. Prescribe silvicultural treatments that promote contiguous areas of mature and late-successional forest land. 2. Use single tree selection, group selection, irregular uneven-aged and intermediate cutting treatments (thinning and release) methods, in combination or singly, when necessary to create diversified stand structure of varying seral stage development and create late-successional stand characteristics. 3. Commercial thin even-aged, single-story canopy stands that are within the designated 15 percent late-successional retention areas. 4. Consider selective harvest where dwarf mistletoe infestations have killed moderately sized patches of trees within the retention areas.	High High High High
	Treat low elevation pine stands selected to meet the 15 percent late-successional retention requirement as soon as possible to restore pine species as the dominant species.	1. Use the single tree selection and group selection methods to establish pine species regeneration on dry, ponderosa pine sites. Douglas-fir should be the species targeted for harvest from these sites. 2. Create open park-like pine stands over time that have diverse stand structure (many different age classes and canopy layers).	High High
	Create openings and suitable seedbeds to promote the establishment and growth of pine species (especially sugar pine), incense cedar and Douglas-fir. Increase the species composition of these species in forest stands where they are under represented.	1. Use the group selection method to create openings of 0.25 to 2.0 acres. Approximately 5 to 20 percent of the commercial forest lands would receive the group selection method of harvest with a random pattern of group distribution across the landscape. 2. Create favorable seedbed conditions for ponderosa pine through prescribed burning or other methods that would reduce the thickness of the soil duff layer, especially around the pine trees. Plant trees in the openings to ensure adequate stocking of pine species.	High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Seedlings through Poles, Large Poles, Mature, and Late-Successional Vegetation Classes	Assure survival of individual trees with late-successional characteristics by reducing vegetation competition in second growth timber stands. This also preserves genetic material.	1. Reduce competition in matrix lands by removing second growth trees that surround trees with late-successional characteristics. Create an approximate 25-foot crown space between the old tree and the remaining second growth trees. Cut only trees that are not associated (crowns entwined) with the late-successional tree.	High
	Design silvicultural prescriptions to manage dwarf mistletoe infestations (for Matrix lands, but may be applied to late-successional areas).	1. Use selection method, pruning, and prescribed burning methods to control the rate and intensity of the parasite. Keep the mistletoe in draws and off of ridges.	High
	Use selection silvicultural methods to manage for root rot (*Phellinus weirii*, *Armillaria mellea*, and *Fomes annosus*) where prevalent in forest stands (for Matrix lands, but may be applied to late-successional areas).	1. Use single tree and strip selection methods to control the spread of the root rot. 2. Plant resistant species in openings created by tree mortality. 3. Use the selection silvicultural methods to develop diverse stand structure and species composition over time in the infected areas.	High High High
	Reduce the fire hazard of the timber stands by decreasing the ladder fuels while meeting the needs identified under other resource programs (for Matrix lands, but may be applied to late-successional areas).	1. Decrease the ladder fuels in forest stands by cutting only dense patches of suppressed tree regeneration and shrub species, and the pruning of tree limbs. These treatments should eliminate fire fuels to a height of 6 to 12 feet above ground level. Cut tree limbs that extend into the pruning height area. 2. Form a mosaic of vegetative patterns by leaving untreated patches of vegetation scattered throughout the landscape.	High High
	Retain at least 15 percent of all project areas, distributed throughout the landscape in an untreated condition. Untreated areas should be a minimum of 2.5 acres in size and can be in any combination of vegetation condition classes.	1. Use landscape design to maintain designated patches of untreated vegetation in strategic locations (e.g., Riparian Reserves; critical habitat; wildlife corridors; areas between existing tree plantations, shrublands, woodlands, etc.).	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Seedlings through Poles, Large Poles, Mature, and Late-Successional Vegetation Classes	Provide for well distributed coarse woody material (CWM - Any large piece of woody material having a diameter greater than 4 inches and a length greater than 39 inches) across the landscape for maintaining the ecological functions of the species dependent on coarse wood (Appendix I). Protect the largest coarse woody material already on the ground from management activities to the greatest extent possible.	1. Leave a minimum of 120 linear feet of class 1 and 2 logs per acre greater than or equal to 16 inches in diameter at the large end and 16 feet in length in regeneration harvest areas as prescribed in the Standard and Guidelines for CWM listed in the Northwest Forest Plan ROD (USDA and USDI 1994a; Appendix J).	High
		2. Amounts of CWM can be modified in areas of partial harvest to reflect the timing of stand development cycles that provide for snags and subsequent CWM from natural suppression and overstocking mortality. The advantages of treatment to improve habitat conditions beyond natural conditions should be assessed. The amount of CWM to leave should fall within a range of the average natural distribution. For projects in the watershed, no less than 15 to 20 percent ground cover of CWM or less than 4.5 tons/acre will be acceptable. Smaller log pieces may be counted when they meet designated standards (Appendix K). Leaving green trees and felling to provide a source of CWM should be part of the partial harvest prescription. The intent is to provide a source of CWM well distributed across the landscape after harvesting. Amounts of CWM to be retained across the landscape should be analyzed at the project level.	High
		3. Exceed the standards and guidelines of the Northwest Forest Plan for CWM where forest stands are experiencing mortality and excess large CWM (16 inches or greater in diameter at the large end) is available. Girdle large diameter green trees in healthy stands to provide large diameter CWM for wildlife habitat and/or soil productivity.	High
		4. Perform surveys to determine average amounts of coarse woody material over the landscape for the commercial timber land base.	High
		5 Leave all trees that are providing shade for CWM that is 20 inches in diameter at the small end and a minimum of 8 feet long.	High
		6. Recruit CWM levels gradually over time in partial harvest areas that are appropriate for the site. It may take two to three stand entries to acquire desired amounts of CWM especially in regard to large end log diameter requirements.	Medium
		7. Avoid consumption of CWM during prescribed burning activities.	Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Early Seral and Seedlings Vegetation Classes	Enhance structural diversity of existing, young even-aged forest stands.	1. Enhance the structural diversity of these vegetation classes by precommercial thinning treatments at staggered intervals and favoring trees of different heights and species at the time of treatment. 2. Perform release treatments as needed.	Medium Medium
Hardwood Vegetation Class	Maintain or improve the natural functions and processes of the native grass/oak woodlands plant associations where appropriate.	1. Manipulate vegetation species as necessary to maintain the natural functions and processes of the native grass/oak woodland plant associations. 2. Discourage high stocking densities of conifers by using manual treatments and prescribed burning. 3. Manage the abundance of shrub and noxious weed species. 4. Reduce the density of hardwoods to increase water and nutrient availability to the hardwoods for mast production where necessary. 5. Use prescribed burning to accomplish recommendations 1 through 4. 6. Seed native grass species into areas of exposed, disturbed soil before noxious weeds become established. Under certain circumstances, desirable non-native grass species will be seeded where feasible (see Appendix L).	High High High High High High
	Introduce a younger age class into the oak woodlands.	1. Cut suppressed and intermediate crown class trees to induce sprouting. Manage the sprout clumps to favor growth of the dominant sprouts. After the vigor is restored to the oak trees, acorn crops should provide for more natural regeneration. 2. Plant oak trees where appropriate.	Medium Low

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Shrub Vegetation Class	Maintain the integrity of the shrublands.	1. Manage the density and species composition of the shrubs. 2. Concentrate density reduction efforts on the extremely dense shrublands on the south facing slopes and where there is important big game habitat. 3. Control or retard the spread of non-native species especially noxious weeds (See Non-native Noxious Weed recommendations). 4. Use prescribed burning to accomplish recommendations 1 through 4. 5. Seed native grass species into areas of exposed, disturbed soil before noxious weeds become established. Under certain circumstances, desirable non-native grass species will be seeded where feasible (see Appendix L). 6. Manage tree species to maintain the dominance of the desired shrub species.	High High High High High Medium
Grass Vegetation Class	Maintain and/or improve the species composition of the native grasslands.	1. Treat tree and shrub species with prescribed fire to maintain the dominance of native grasses. 2. Seed native grasses on recently disturbed areas to prevent the establishment of noxious weeds. Under certain circumstances, desirable non-native grass species will be seeded where feasible (see Appendix L). 3. Control or retard the spread of non-native species especially noxious weeds (See Non-native Noxious Weed recommendations). 4. Develop a native grass propagation program for grasses found in the watershed.	High High High Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
FIRE AND AIR QUALITY			
Safety	Provide for firefighter and public safety in all fire management activities (including wildfires) across the landscape. This objective is mandated by the Department of Interior as the first priority in every fire management activity (USDI and USDA 1995).	1. Treat high hazard areas around the rural interface areas. Reduce canopy closures, ground and ladder fuels in order to increase protection of private lands and structures. Treatment of fuels on private lands within the rural interface is mostly dependent on factors outside the control of the BLM. 2. Retain fire access routes based on transportation management objectives. These routes are needed to allow quick response times to wildfire starts and escape routes for the public and firefighters. 3. Treat fuels adjacent to identified high values at risk such as recreation and historic sites. Treatments would include under-burning, slashing and brushing, lop and scatter, and hand-pile and burn. 4. Coordinate with adjacent private landowners to treat hazardous fuels on private lands.	High High High High
Resource Protection	Promote long-term resistance of the lower and mid elevation areas to stand replacement wildfires by reducing the fuel hazard.	1. Treat areas of continuous high hazard fuels in order to help reduce the size and intensity of wildfires. High priority areas would be adjacent to the rural interface area and adjacent to high values at risk (listed in Table 14, Current Condition section). Treatments should include commercial thinning of overstocked stands and treatment of ground and ladder fuels in both commercial and noncommercial timber lands. 2. Develop overall project strategy to reduce fuel hazard resulting from land management activities. 3. Utilize prescribed burning to maintain plant communities such as grasslands and oak woodlands. Fire will not only maintain these communities but also reduce the fuel hazard of these areas.	High High High
Air Quality	Minimize adverse impacts to air quality from fire management activities and wildfires.	1. Conduct all fire management activities in compliance with all federal, state, and local smoke management regulations. 2. Monitor levels of particulate matter produced from fire management activities and wildfires to further refine smoke emissions mitigation practices.	High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
TERRESTRIAL WILDLIFE SPECIES AND HABITAT			
Terrestrial Wildlife Species and Habitat	Maintain or enhance current native terrestrial wildlife populations and distribution.	1. Develop and/or maintain an appropriate amount and distribution of seral stages of the various plant communities found in the watershed.	High
		2. Identify, protect, and where appropriate, enhance the special habitats identified in the Medford and Redding Resource Management Plans, such as caves/mines, talus, wetlands, and meadows.	High
		3. Maintain adequate numbers of snags and amounts of coarse wood material (see Vegetation recommendations) for those species that require these special habitats for breeding, feeding, or sheltering.	High
		4. Identify and protect, maintain, or improve dispersal corridors within the watershed and between adjacent watersheds.	High
		5. Follow Transportation recommendations for wildlife.	High
		6. Restore oak/pine woodlands through prescribed fire and appropriate silvicultural methods.	High
		7. Rehabilitate/rejuvenate shrublands through prescribed fire or other efficacious techniques.	High
		8. Restore native grasslands.	High
		9. Develop water sources where needed to improve wildlife distribution and habitat use within the watershed.	High
	Ensure management activities do not lead to listing of special status species as threatened or endangered.	1. Inventory special status species suspected to occur in the watershed.	High
		2. Protect, maintain, or improve habitat conditions as necessary for those special status species found.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
HYDROLOGY			
Hydrology	Maintain and enhance instream flows sufficient to create and sustain riparian, aquatic, and wetland habitats and to retain patterns of sediment, nutrient, and wood routing. Protect the timing, magnitude, duration, and spatial distribution of peak, high, and low flows (Aquatic Conservation Strategy Objective #6, USDA and USDA 1994a:B-11).	**Reduce the potential for altering the timing, magnitude, duration, frequency and spatial distribution of peak flows through the following:** 1. Follow Transportation recommendations. 2. Manage vegetation within the transient snow zone to minimize large openings. Analyze site-specific projects for cumulative watershed effects on a drainage area (generally less than 6,000 acres) basis. Assess watershed conditions (e.g., riparian and stream channel condition, geomorphic landform, slope stability, precipitation, and compacted area) and reference conditions (including natural variability) to determine the percent hydrologic recovery that is appropriate for each drainage area. 3. Reduce upland fire hazard to minimize potential for catastrophic wildfires. **Attempt to increase summer flows through the following:** 4. Encourage spring protection and minimize surface/groundwater diversions on public lands to ensure attainment of the Aquatic Conservation Strategy Objectives.	 High High High High
	Maintain and enhance the timing, variability, and duration of floodplain inundation and water table elevation in meadows and wetlands (Aquatic Conservation Strategy Objective #7, USDA and USDA 1994a:B-11).	1. Follow Transportation recommendations. 2. Follow interim Riparian Reserve widths identified in the ROD Standards and Guidelines for wetlands greater than one acre. Designate Riparian Reserve widths of 100 feet slope distance from the outer edge of wetlands less than one acre.	High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
STREAM CHANNEL			
Stream Channel	Maintain and enhance the natural channel stability by allowing streams to develop a stable dimension, pattern, and profile such that, over time, channel features are maintained and the sediment regime under which aquatic ecosystems evolved is maintained or enhanced.	1. Follow Transportation recommendations. 2. Assess stream width-to-depth ratios, and reduce in appropriate stream reaches. Methods for reducing width-to-depth ratios include promoting point bar development through riparian vegetation and other energy dissipators.	High High
	Maintain and enhance the physical integrity of the aquatic system, including stream banks and bottom configurations (Aquatic Conservation Strategy Objective # 3, USDA and USDA 1994a:B-11).	1. Promote growth of conifer and hardwood trees within Riparian Reserves, using silvicultural methods if necessary to reach late-successional characteristics (where capable) for future large wood recruitment (see Riparian recommendations). 2 Minimize activities that impact streambanks and riparian vegetation. 3. Maintain or enhance the streams' ability to dissipate the energy from high stream flows. Assess need for energy dissipators in stream channels and consider adding energy dissipators such as meanders, large woody material or boulders, and riparian vegetation where appropriate.	High High Medium
	Maintain and enhance the sediment regime under which the aquatic ecosystem evolved (Aquatic Conservation Strategy Objective # 5, USDA and USDA 1994a:B-11).	1. Follow Transportation and Erosion Processes recommendations. 2. Reduce the potential for altering the timing, magnitude, duration, frequency, and spatial distribution of peak flows (see Hydrology section). 3. Assess for eroding stream banks and stabilize where appropriate.	High High Medium

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
WATER QUALITY			
Water Quality	Maintain and enhance water quality necessary to support healthy riparian, aquatic, and wetland ecosystems (Aquatic Conservation Strategy Objective # 4, USDA and USDA 1994a:B-11). Achieve the principal water quality objectives in the Klamath-Iron Gate Watershed by reducing summer stream temperatures and sedimentation.	1. Apply appropriate Best Management Practices (BMPs) (USDI 1995a, pages 149-177) to minimize soil erosion and water quality degradation during management activities.	High
		2. Follow Riparian Reserve recommendations.	High
		Reduce summer stream temperatures through the following (also see Stream Channel recommendations):	
		3. Plant or maintain native species (from local genetic stock) in riparian areas and wetlands to provide adequate stream shading.	High
		4. Protect riparian vegetation that provides stream shading as specified in the Riparian recommendations.	High
		5. Continue monitoring stream temperature in East and West Forks of Camp Creek to determine if they should be placed on the Oregon 303(d) list.	High
		6. Reduce stream width-to-depth ratio (see Stream Channel recommendations).	Medium
		Reduce stream sedimentation through the following:	
		7. Follow Transportation, Erosion Processes, and Stream Channel recommendations.	High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Yreka Community Water Supply	From BLM-administered lands in the Fall Creek drainage and above the PacifiCorp Spring Creek diversion in Jenny Creek, provide high quality water that, with adequate treatment by the City of Yreka, can meet water quality requirements of the Safe Drinking Water Act.	1. Conduct site-specific analysis for potential effects on water quantity and quality prior to any proposed management activity in the area contributing to the Yreka community water supply. 2. Use interdisciplinary team process to identify and evaluate potential watershed/riparian/stream restoration projects in the area contributing to the Yreka community water supply. 3. Manage for no net increase in the road miles on BLM-administered lands within the area contributing to the Yreka community water supply. 4. Follow Riparian Reserve and Transportation recommendations. 5. Coordinate with the City of Yreka and Jackson County Planning Department on the proposed county designation for an Area of Special Concern.	High High High High High
RIPARIAN AREAS			
Riparian Reserves	Maintain and enhance the species composition and structural diversity of plant communities in riparian areas and wetlands to provide adequate summer and winter thermal regulation, nutrient filtering, appropriate rates of surface erosion, bank erosion, and channel migration, and to supply amounts and distributions of coarse woody material sufficient to sustain physical complexity and stability. Protect ground water flow.	1. Follow the interim Riparian Reserve widths outlined in the Northwest Forest Plan (USDA and USDI 1994a). 2. Change or discontinue management activities that may prevent or retard restoration and/or enhancement of Riparian Reserve habitat. 3. Use an interdisciplinary process to design site-specific Riparian Reserve treatments if necessary to maintain and enhance riparian vegetation condition.	High High High

RESOURCE	OBJECTIVES	RECOMMENDATIONS	PRIORITY
Riparian Reserves	Maintain and enhance riparian habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependent species, especially taking into consideration long-term plant community changes. (see Plant and Wildlife recommendations).	1. Give Riparian Reserves located adjacent to fish-bearing streams the highest priority for restoration to late-successional characteristics. Implement riparian silviculture (density management) in Riparian Reserves to increase the large conifer component in fish-bearing streams, with early and mid-successional stands. 2. Implement riparian silviculture to reduce fire hazard especially where there are mid and late successional conifer components within the Riparian Reserves of fish-bearing streams that are at risk of damage (or elimination) due to fire.	High Medium
	Give the highest priority for restoration to the most degraded Riparian Reserves.	1. Follow Transportation recommendations. 2. Identify problem areas within Riparian Reserves (especially streambanks and wetlands) and institute corrective measures.	High High
AQUATIC WILDLIFE SPECIES AND HABITAT			
Aquatic Wildlife Species and Habitat	Maintain or enhance viable resident salmonid fish and other aquatic wildlife populations with individuals of all life stages throughout their habitat.	1 Ensure that management activities on public lands meet the Aquatic Conservation Strategy (ACS), Medford and Redding resource management plans, and Best Management Practices (BMPs).	High
	Restore and protect aquatic habitat for all resident fish and other aquatic resources. Restore and protect spatial and temporal connectivity within and between watersheds.	1. Restore and/or diversify fish habitat and floodplain connectivity to maintain pool habitat, fish cover, spawning gravels, and bank stability. 2. Promote future large wood recruitment in Riparian Reserves. 3. Improve water quality and increase water quantity. Adhere to Water Quality and Hydrology recommendations. 4. Avoid activities that degrade streambanks and riparian areas. Adhere to Riparian recommendations. 5. Follow Transportation and Erosion Processes recommendations. 6. Maintain or improve vegetation within 100 feet of headwater streams/bogs/springs/wetlands for amphibian, macroinvertebrates, and other wildlife. Consider fencing springs, seeps, and water developments to protect water quality and riparian ecosystems.	High High High High High High

LANDSCAPE PLANNING OBJECTIVES AND RECOMMENDATIONS FOR BLM-ADMINISTERED LANDS

Recognizing that the landscape of the Klamath-Iron Gate Watershed is a complex web of interacting ecosystems, the watershed analysis team blended individual resource information to develop a landscape picture for BLM-administered lands. The team looked at the current condition of the terrestrial and aquatic components of the landscape and synthesized the information to formulate landscape level objectives and recommendations. These landscape level objectives and recommendations for BLM-administered lands provide valuable information for planning projects and making management decisions. Map 22 shows areas across the landscape that need special consideration prior to project planning.

LANDSCAPE AREA	OBJECTIVES	RECOMMENDATIONS
Riparian Reserves	Maintain and enhance Riparian Reserve habitat to support well-distributed populations of native plant, invertebrate, and vertebrate riparian-dependant species, especially taking into consideration long-term plant community changes.	1. Follow the interim Riparian Reserve widths identified in the Northwest Forest Plan (USDA and USDI 1994a) until site specific analysis occurs at the project level. 2. Follow Riparian Reserve module (USDA et al. 1997) to change boundary widths. 3. Use an interdisciplinary process to design site-specific silvicultural treatments as needed to meet Aquatic Conservation Strategy objectives. 4. Reroute, obliterate, and/or decommission roads, skid trails, and landings within Riparian Reserves where appropriate. 5. Improve riparian vegetation, stabilize streambanks, and reduce sediment.
District Defined Reserve	Protect and enhance conditions of late-successional and old-growth forest ecosystems, which serve as habitat for late-successional and old-growth forest related species including the northern spotted owl.	1. Manage in accordance with the Jenny Creek Late-Successional Reserve Assessment recommendations.

LANDSCAPE AREA	OBJECTIVES	RECOMMENDATIONS
Wilderness Study Area	Manage the Soda Mountain Wilderness Study Area to protect its resource values and to maintain its natural conditions.	1. Continue to monitor the Soda Mountain Wilderness Study Area according to the interim management policy.
Special Recreation Management Area	Manage the Pacific Crest National Scenic Trail to protect its resource values and to maintain its natural conditions.	1. Continue to manage the Pacific Crest National Scenic Trail according to the comprehensive management plan and the Medford District's management plan for the Trail.
Pokegama Wild Horse Management Area	Manage the Pokegama Wild Horse Management Area to provide for a viable population. (Coordinate with Klamath Falls Resource Area which has the lead for the herd area).	1. Ensure the protection and management of the Pokegama wild horse herd. 2. Provide adequate forage and water to sustain a healthy population. 3. Remove animals as necessary when populations exceed prescribed management levels.
Special Areas	Manage Pilot Rock as an Area of Critical Environmental Concern for geologic, historic, scenic, wildlife, and botanical values. Manage Scotch Creek Research Natural Area for scientific research and baseline study. Manage the Cascade/Siskiyou Ecological Emphasis Area according to the management plan being developed.	1. Follow management specified in the BLM Medford District Resource Management Plan (USDI 1995a) and specific management plans as they are developed.

LANDSCAPE AREA	OBJECTIVES	RECOMMENDATIONS
15 Percent Late-Successional Retention Areas	Meet or exceed the 15 percent late-successional retention requirement on federal forest lands to provide habitat to function as refugia for old-growth associated species that have limited dispersal capabilities such as fungi, lichens, bryophytes and vascular plants (see Appendix I and Map 21).	1. Reserve late-successional stands in all vegetation zones. 2. Ensure that retained stands are distributed across the landscape. 3. Identify and treat target stands to speed development of late-successional or old-growth habitat that will support a more connected network of continuous habitat than currently exists. 4. Treat reserve stands where necessary to maintain and create late-successional components, such as canopy cover, snags, and class I and II coarse wood (see Management Objectives and Recommendations, Vegetation, for coarse woody material amounts). 5. Prescribe silvicultural treatments aimed at restoring and preserving late-successional pine characteristics in pine associated stands that have been identified for retention, but are overstocked with Douglas-fir and other species.
Matrix	Manage designated parcels of matrix land consistent with their special land use allocation requirements. Provide general connectivity (along with other land use allocations such as Riparian Reserves) between late-successional reserves.	1. Manage by appropriate vegetation condition classes to provide for a variety of stand structures while maintaining all native species. A variety of silviculture methods and prescriptions can be applied. 2. Provide a renewable supply of large live trees and snags well distributed across the landscape in a manner that provides habitat for cavity using birds, bats, and other species. Regeneration harvest is an option when appropriate stand structures are retained, i.e. 16 to 25 large green trees per acre, and a minimum of 40% canopy closure (USDI 1995a). 3. Leave a minimum of 120 linear feet per acre of logs that are 16 inches or greater in diameter and 16-feet long. Retain coarse woody material already on the ground and protect it from disturbance during treatment.

LANDSCAPE AREA	OBJECTIVES	RECOMMENDATIONS
High Fire Hazard Areas	Treat all vegetation condition classes in strategic locations, especially commercial forest stands, to ensure their survival from insects and fire, and enhance seral and structural development of the condition classes.	1. Develop prescriptions that reduce fire hazard and improve vegetation health to protect natural resources or sites of cultural value from biotic disturbances (fire and wind). 2. Manage vegetation density of all vegetation condition classes to accomplish this objective. 3. Use selection silvicultural harvest methods to create or enhance the development of late-successional forests. 4. Treat pine series forest in the commercial base to create open park-like structure. 5. Target Douglas-fir stands for density management adjacent to shrublands or woodlands on south and west slopes, or on ridges that receive sunlight for most of the day.
Wildlife Connectivity	Maintain or improve connectivity between the Klamath-Iron Gate Watershed and surrounding watersheds.	1. Employ silvicultural treatments in conifer stands in the Fall Creek drainage that will speed up development of late-successional habitat.
Northern Spotted Owl Critical Habitat Unit OR-38 (Matrix lands)	Maintain or improve dispersal conditions for northern spotted owls.	1. Establish 100 acre late-successional reserves around all new nest sites found in the critical habitat unit. 2. Minimize the loss or degradation of suitable spotted owl habitat within 0.7 miles of known spotted owl nest sites.
Horseshoe Ranch Wildlife Area/Deer Winter Range	Improve deer winter range habitat conditions.	1. Minimize vehicular disturbance during the winter period (Nov. 15-Apr. 15). 2. Rejuvenate decadent brushlands. 3. Restore native grasslands. 4. Develop water sources as needed. 5. Continue to implement the Pokegama seasonal road closure as outlined in the Cooperative Agreement and subsequent amendments to the Cooperative Agreement.

LANDSCAPE AREA	OBJECTIVES	RECOMMENDATIONS
Yreka Community Watershed	Provide high quality water that with adequate treatment by the City of Yreka can meet water quality requirements of the Safe Drinking Water Act.	1. Conduct site-specific analysis for potential effects on water quantity and quality prior to any proposed management activity in the area contributing to the Yreka community water supply. 2. Use interdisciplinary team process to identify and evaluate potential watershed/riparian/stream restoration projects in the area contributing to the Yreka community water supply. 3. Manage for no net increase in the road miles on BLM-administered lands within the area contributing to the Yreka community water supply. 4. Follow Riparian Reserve and Transportation recommendations identified in the Management Objectives and Recommendations section. 5. Coordinate with the City of Yreka and Jackson County Planning Department on the proposed county designation for an Area of Special Concern.
Transient Snow Zone	Protect the timing, magnitude, duration, and spatial distribution of peak streamflows.	1. Manage forest stands within the transient snow zone to minimize large openings where appropriate and feasible. Analyze site-specific projects for cumulative watershed effects on a drainage area (generally less than 6,000 acres) basis. Assess watershed conditions (e.g. riparian and stream channel condition, geomorphic landform, slope stability, precipitation, and compacted area) and reference conditions (including natural variability) to determine the percent hydrologic recovery that is appropriate for each drainage area.
Roads of Concern	Reduce road density and road-caused erosion, stabilize roads that are unstable, and reduce wildlife disturbance.	1. Review roads of concern listed in Appendix M and consider stabilizing, closing, or decommissioning.

DATA GAPS

This section identifies information that was not available for the analysis. Items under each ecosystem element/subelement are listed in priority order if funding becomes available for data collection.

Human Uses

Unauthorized Use

1. Property lines in locations where unauthorized use is suspected.

Transportation

1. Road condition surveys.

Grazing

1. Potential cooperative livestock related projects on private lands within the watershed.

Archaeological Sites

1. Systematic archaeological survey.
2. Formal evaluation of known archaeological sites.

Erosion Processes

1. Field inventory and GIS mapping of all recent and active landslides and severely eroded terrain on BLM lands.
2 Sedimentation rates/volumes from surface erosion and landslides.
3. Quantification of landslide and erosion rates accelerated by federal land management (i.e., roads and clearcut harvesting) versus natural erosion rates.

Soil Productivity

1. Duff thickness for various vegetation types within the watershed.
2. Rates of ravel movement for varying surface conditions.
3. Extent of soil productivity reduction caused by intense fire and/or fire related salvage logging.
4. Inventory of erosion sites.
5. Quantification of disturbance effects on long-term soil productivity.
6. Amount of coarse woody material (by decay class) across the landscape.

Special Status Plant Species and Habitats

1. Inventory of Special Status plants.
2. Inventory and population data of nonnative plant species, including noxious weeds.
3. Demographic data on known populations.
4. Species response to management practices.

Survey and Manage Plant Species and Habitats

1. Inventory for survey and manage lichens, bryophytes, and fungi.
2. Species distribution data.
3. Species response to manipulation or micro-climate modification.
4. Species habitat requirements.
5. Relationship of stand age to population viability.

Forest Density and Vigor

1. Comprehensive data on drought tolerance for tree and shrub species (in bars of water tension).
2. More statistical data regarding the historic range, frequency, and distribution of vegetation over the landscape (should include all pine species, incense cedar, oak species, Oregon ash, and even Douglas-fir).

Fire and Air Quality

1. Exact acreage and location of existing and past high hazard, medium hazard, and low hazard areas.
2. Data regarding the range, frequency, distribution, and interaction of insects, animals, vegetation and fire intensities.
3. Wildfire intensities and consumption rates over the landscape during differing climatic conditions through time.
4. Cultural understanding of fire use during prehistoric times.
5. Complete fire start information (e.g., location, cause, time) prior to 1969.
6. Classification of land by plant association within and outside fire regimes.
7. Utilizing above data to predict wildfire severity potential within the watershed through predictive models such as RERAP, and FARSITE.
8. Information regarding past and present trends in air quality due to fire management and wildfire activities.
9. Data regarding changes in populations of fire dependant plant and animals species.

Terrestrial Wildlife Species and Habitats

1. Prehistoric, existing and desired relative abundance and patch size distribution of the vegetation condition classes found in the watershed.
2. Occurrence, distribution, and population data for special status, survey and manage, and protection buffer species found in the watershed.
3. Snag and coarse woody material abundance by vegetation condition class.
4. The degree of impact to wildlife as a result of OHV use of the Schoheim Road.

Hydrology

1. Field survey to identify stream categories for nonfish-bearing streams (permanently flowing or intermittent).
2. Soil compaction analysis for the watershed.
3. Continuously recorded streamflows.
4. On-the-ground wetland inventory.

Stream Channel

1. Upland sediment source locations and causes.
2. Physical features and stability of nonfish-bearing streams.
3. Amount of large woody material in nonfish-bearing streams.

Water Quality

1. Water quality data for Scotch, Camp, and Fall Creeks and their tributaries (dissolved oxygen, pH, bacteria sediment, turbidity, and nutrients).

Riparian Areas

1. Amount of large woody material in riparian areas.
2. Amount, diversity, and age of riparian vegetation.

Aquatic Wildlife Species and Habitats

1. Genetic composition of resident trout.
2. Influence of non-native salmonids on native populations in lower stream reaches (above Iron Gate Reservoir.
3. Species, distribution and relative abundance of aquatic macroinvertebrates and amphibians.
4. Influence (impacts) on resident salmonids and macroinvertebrates in Fall Creek from infiltration of salmonids and macroinvertebrates from Spring Creek (Jenny Creek).

MONITORING RECOMMENDATIONS

The following monitoring recommendations are made in order to gain a better understanding of the watershed processes and conditions within the Klamath-Iron Gate Watershed. Items under each ecosystem element are listed in priority order if funding becomes available for monitoring.

Human Uses

1. Monitor cultural resource site conditions (looting and natural deterioration),
2. Monitor cultural resource effectiveness of past survey strategies to locate sites.
3. Monitor changing public opinions, values, and expectations regarding land management issues.

Transportation

1. Monitor roads to ensure that drainage structures are functioning as designed.
2. Monitor culverts on fishery streams to ensure that passage is adequate.
3. Monitor road blocks to ensure that they are effective.

Soil Productivity

1. Survey duff thickness for various vegetation types in the watershed prior to and after management actions.
2. Measure duff thickness after any surface disturbing project and compare against thickness before project. Suggested standard is >90 percent thickness over 90 percent or more of forest project sites.
3. Measure and compare amount of area compacted before and after management actions using ground base equipment, especially in plateau landscape.

Forest Density and Vigor

1. Monitor commercial forest stands for vigor by using relative density as an index.
2. Measure individual tree growth in commercial forest stands.
3. Analyze canopy closure before and after vegetation treatment.
4. Monitor amounts of coarse woody material before and after timber harvesting operations.
5. Monitor the number and quality of snags (and perhaps how the trees were killed: insects or pathogens).
6. Monitor acorn crops after oak woodland treatments.
7. Monitor the survival of individual pine trees after release treatments.
8. Measure humidity and air temperatures across the pre-treatment and post treatment landscape to learn the effects of timber harvest.

Fire and Air Quality

1. Monitor changes in fire hazard over time as landscape fuel hazard reduction treatments are completed.
2. Monitor smoke emissions and impacts from wildfire and fuels management activities.
3. Monitor changes in populations of fire dependant plant and animal species over time.

Terrestrial Wildlife Species and Habitat

1. Monitor site occupancy, reproductive status and reproductive success of threatened/endangered species found in the watershed.
2. Monitor habitat use and population trend of the special status and other priority species found in the watershed.
3. Monitor rate of recruitment/loss of snags and coarse woody material.
4. Monitor rate of seral stage change in the vegetative communities found in the watershed.

Hydrology

1. Monitor changes in transient snow zone openings.
2. Monitor changes in road density and soil compaction.
3. Monitor changes in streamflow as watershed conditions change.

Stream Channel

1. Establish permanent monuments to monitor changes in channel morphology resulting from specific stream improvement projects.
2. Monitor changes in channel stability and condition by conducting periodic physical stream surveys (such as10-year intervals).

Water Quality

1. Continue monitoring stream temperatures.
2. Monitor dissolved oxygen and pH on a regular basis at temperature sites.
3. Monitor sediment, nutrients, and bacteria at selected sites.

Riparian Areas

1. Assess the ability of the Aquatic Conservation Strategy and BLM Medford District Resource Management Plan's standards and guidelines to provide the anticipated level of protection to interim Riparian Reserves.
2. Monitor riparian habitat (i.e., large woody material, shading, microclimate) before and after implementing management prescriptions designed to improve riparian habitat.
3. Assess riparian species composition, age, density and health prior to and in conjunction with timber harvest.

Aquatic Wildlife Species and Habitats

1. Monitor changes in aquatic/riparian habitats, stream temperatures, water quality and fish populations by conducting periodic physical stream surveys and population inventories (i.e. 10-year intervals).
2. Monitor aquatic macroinvertebrate populations to determine the biotic integrity of stream habitat and trends in the watershed.
3. Monitor amphibian populations, such as foothill yellow-legged frog, to determine the biotic integrity of stream habitat and trends in the watershed.

RESEARCH RECOMMENDATIONS

The following research recommendations would provide additional understanding of ecosystem processes in Klamath-Iron Gate Watershed. Items under each ecosystem element are listed in priority order if funding becomes available for research.

Soil Productivity

1. Study rates of ravel movement for various surface conditions.

Special Status Plant Species and Habitats

1. Determine ecological requirements.
2. Determine the effects on individuals and the population of micro-climate changes due to management activities.

Survey and Manage Plant Species and Habitats

1. Determine ecological requirements.
2. Determine the effects on individuals and the population of micro-climate changes due to management activities.
3. Determine relationship of stand age to population viability.
4. Determine the forest tree density level required to sustain population viability.

Forest Density and Vigor

1. Research the soil carbon/nitrogen ratios for various soils in the watershed.
2. Study the available trace elements in the various soils of the watershed and the requirements for the tree species.
3. Perform more comprehensive studies on the ecological requirements of Oregon white and California black oak to produce acorn crops, including optimum tree density (stems/acre), impact of competing vegetation (how much and which species can grow around the oaks?), and the occurrence, frequency, and intensity of fires needed to return nutrients to the soil to maintain healthy, productive oak woodlands.
4. Research how long conifer and hardwood trees can live on low elevation, drought-prone sites.
5. Determine the evapotranspiration rates for all endemic tree and shrub species (in inches of water).
6. Determine how many old-growth trees are needed on a per-acre basis to maintain ecosystem functions of late-successional forests.
7 Determine what the coarse woody material requirements of the watershed are in order to maintain site productivity.

Terrestrial Wildlife Species and Habitat

1. Determine ecological requirements for the special status, survey and manage, and protection buffer species present in the watershed.
2. Determine the optimum mix and distribution of seral stages of the vegetative communities found in the watershed that would maximize the probability of viability of all special

status, survey and manage, and protection buffer species.

Stream Channel

1. Determine amounts of large woody material needed in steep headwater channels.

Water Quality

1. Determine potential for water quality limited streams to exceed state temperature criterion even with riparian canopy providing full shade to stream.

Aquatic Wildlife Species and Habitats

1. Study the impacts of fish introduced into Iron Gate Reservoir on native fish populations in the lower stream reaches of Scotch, Camp and Fall Creeks.
2. Study the impacts of fish and macroinvertebrate infiltration from Spring Creek into Fall Creek.
3. Determine the genetic composition of resident trout in Scotch, Camp and Fall Creeks.
4. Study the species composition and distribution of macroinvertebrate populations in Scotch, Camp and Fall Creeks.

MAPS

Klamath-Iron Gate Watershed

Map 1 Watershed Location

United States Department of the Interior
Bureau of Land Management
Medford District Office
3040 Biddle Road
Medford, Oregon 97504

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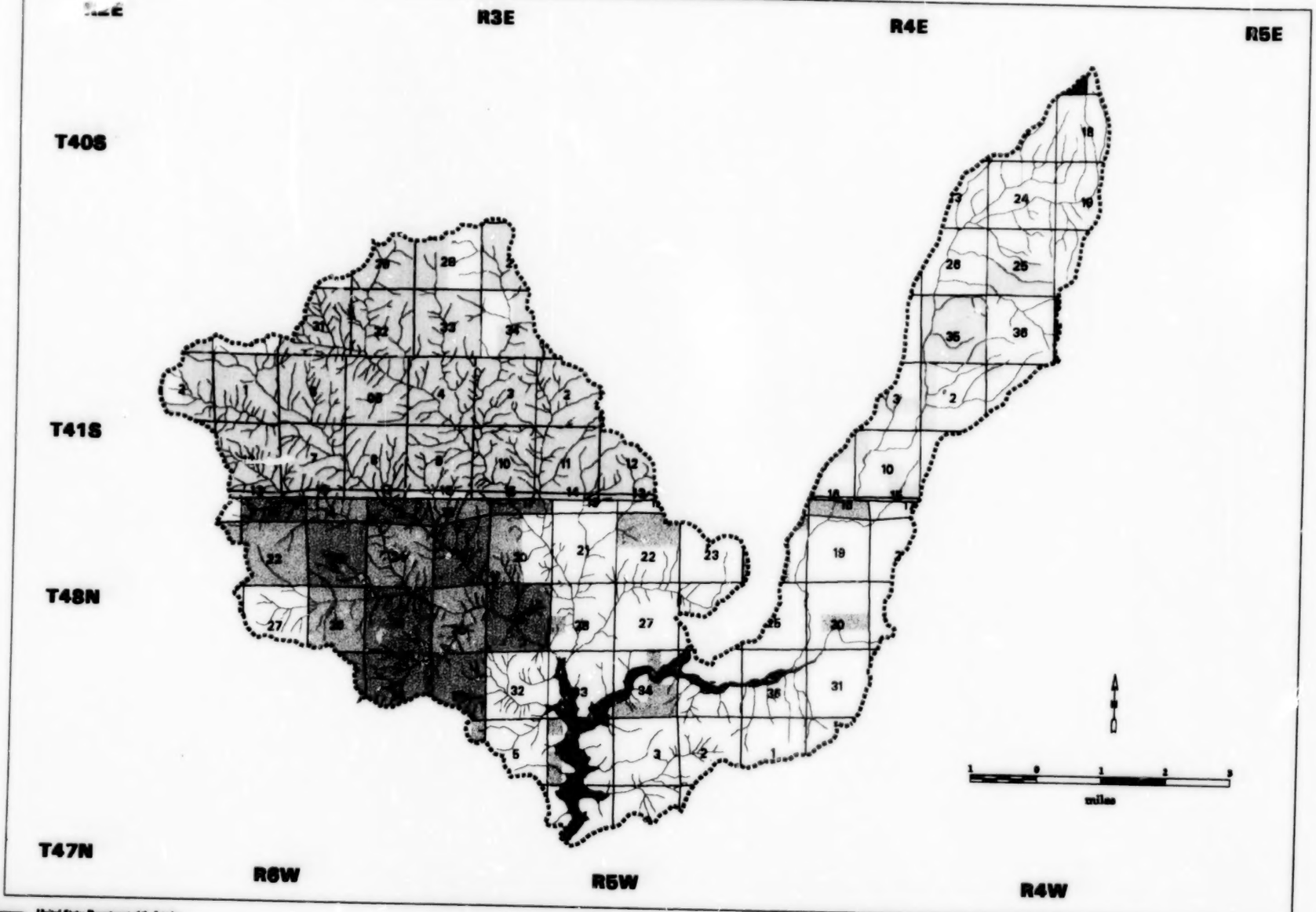
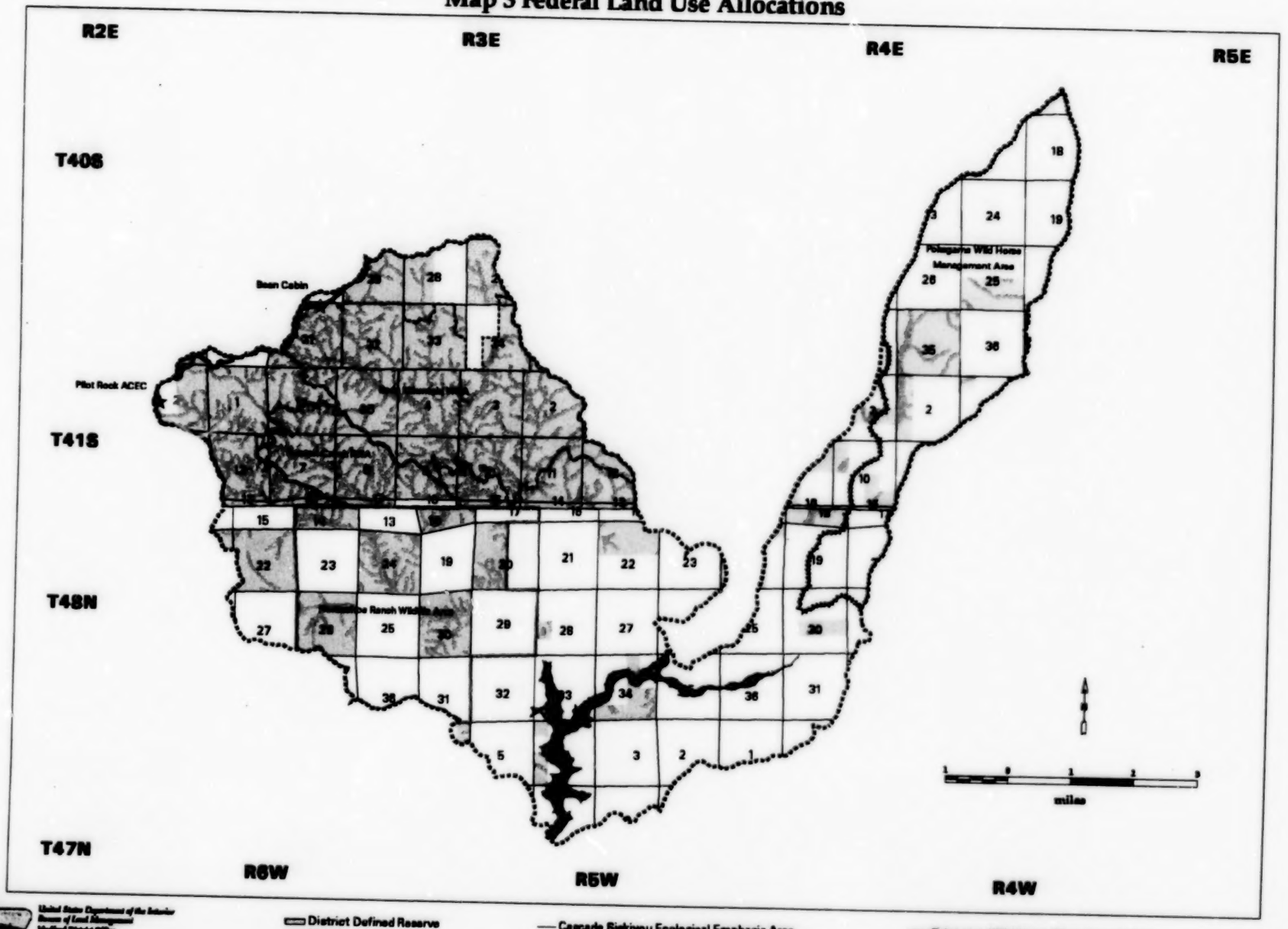
Klamath-Iron Gate Watershed
Map 2 Land Ownership



Map 2

Klamath-Iron Gate Watershed
Map 3 Federal Land Use Allocations



United States Department of the Interior
Bureau of Land Management
Medford District Office
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- District Defined Reserve
- Matrix
- Riparian Reserve
- Iron Gate Reservoir
- Cascade Siskiyou Ecological Emphasis Area
- Horseshoe Ranch Wildlife Area
- Scotch Creek Research Natural Area
- Soda Mountain Wilderness Study Area
- Pokegama Wild Horse Management Area
- Pacific Crest National Scenic Trail
- Klamath-Iron Gate Watershed

Map 3

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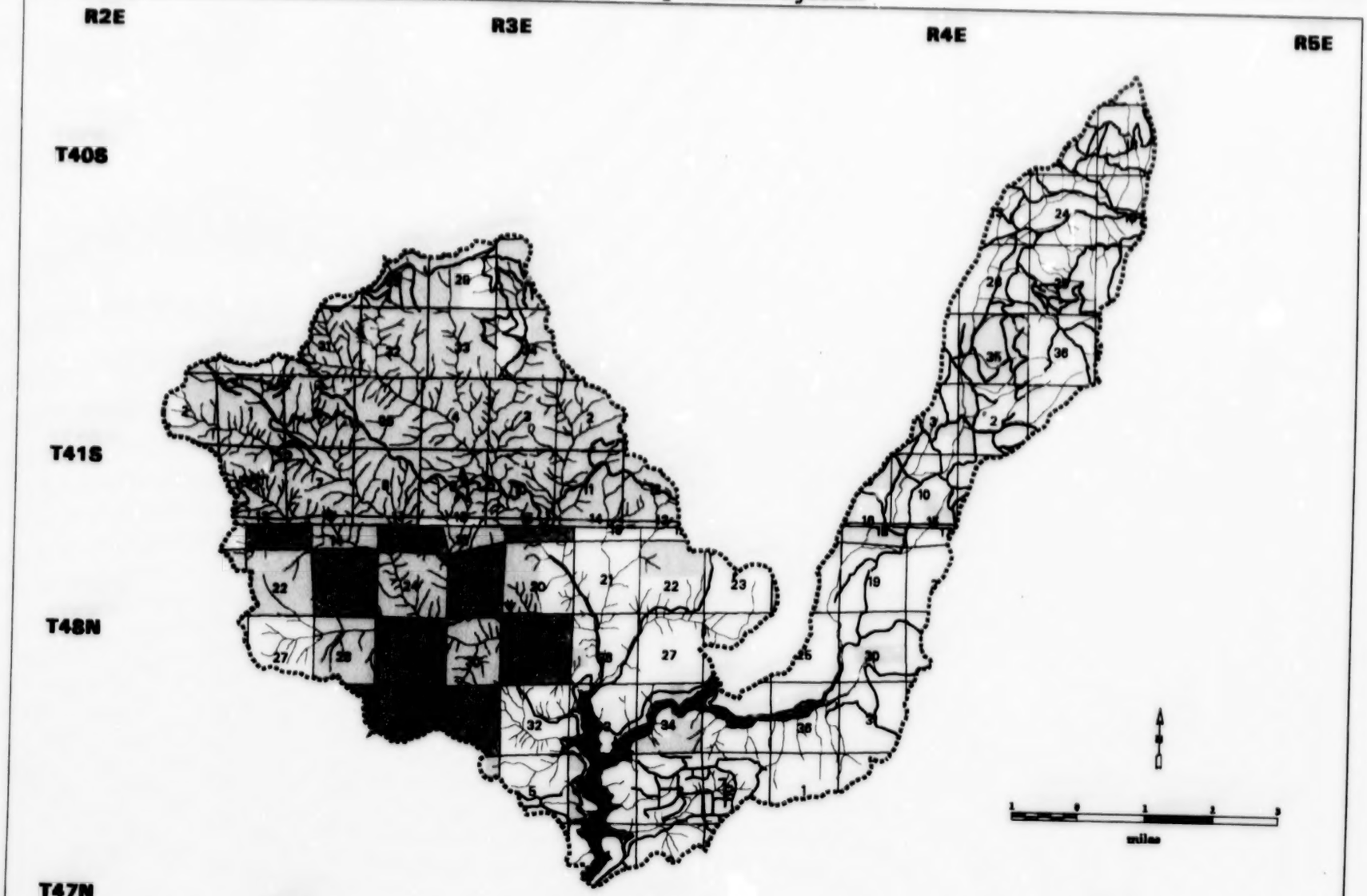
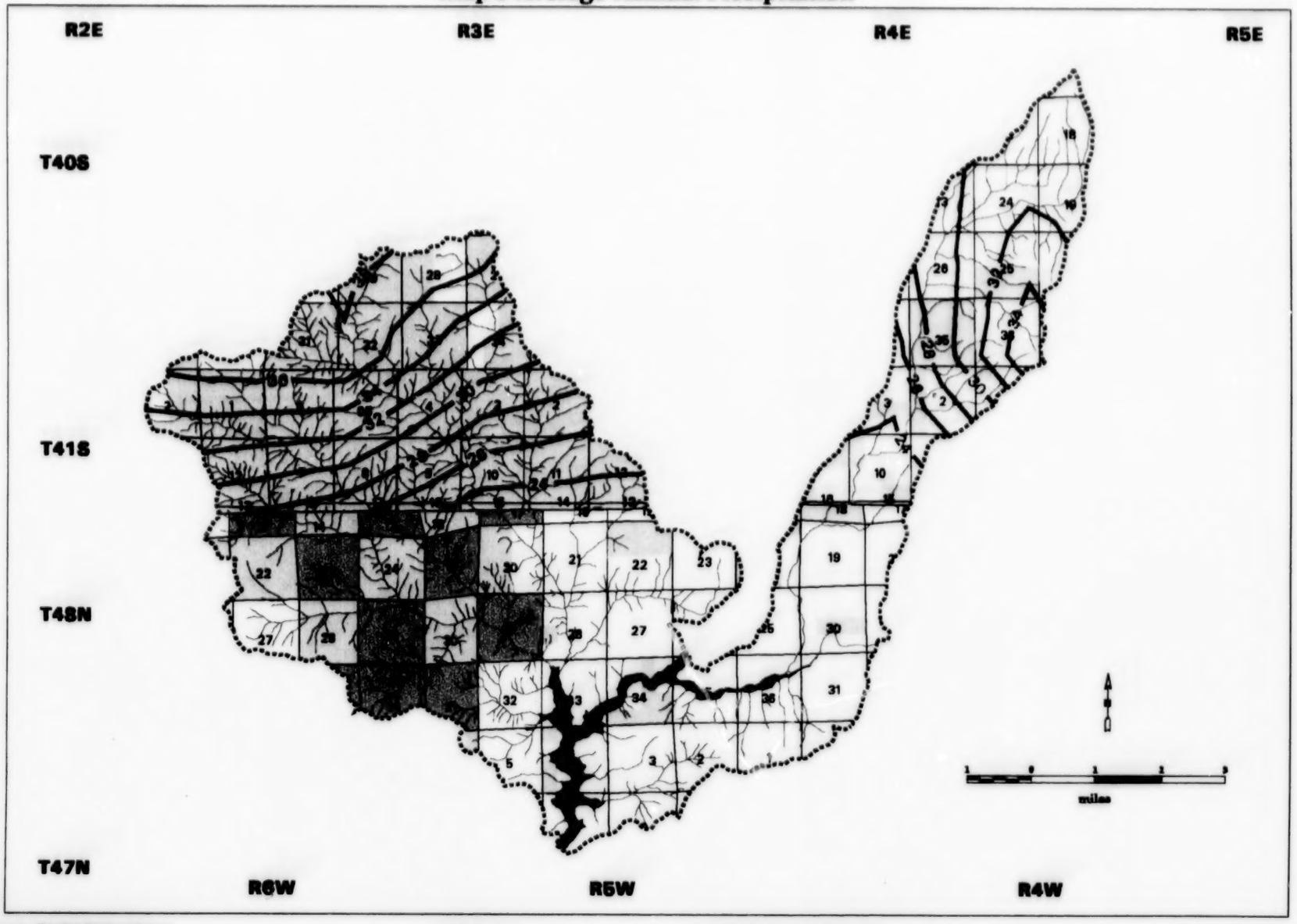
Klamath-Iron Gate Watershed
Map 4 Transportation System



Map 4

Klamath-Iron Gate Watershed
Map 5 Average Annual Precipitation



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Medford District Office
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BLM Lands
State Lands California
Private
Iron Gate Reservoir

Klamath-Iron Gate Watershed
Stream
Average Annual Precipitation Isoline (inches)
Source: Oregon Climate Services 1995

Map 5

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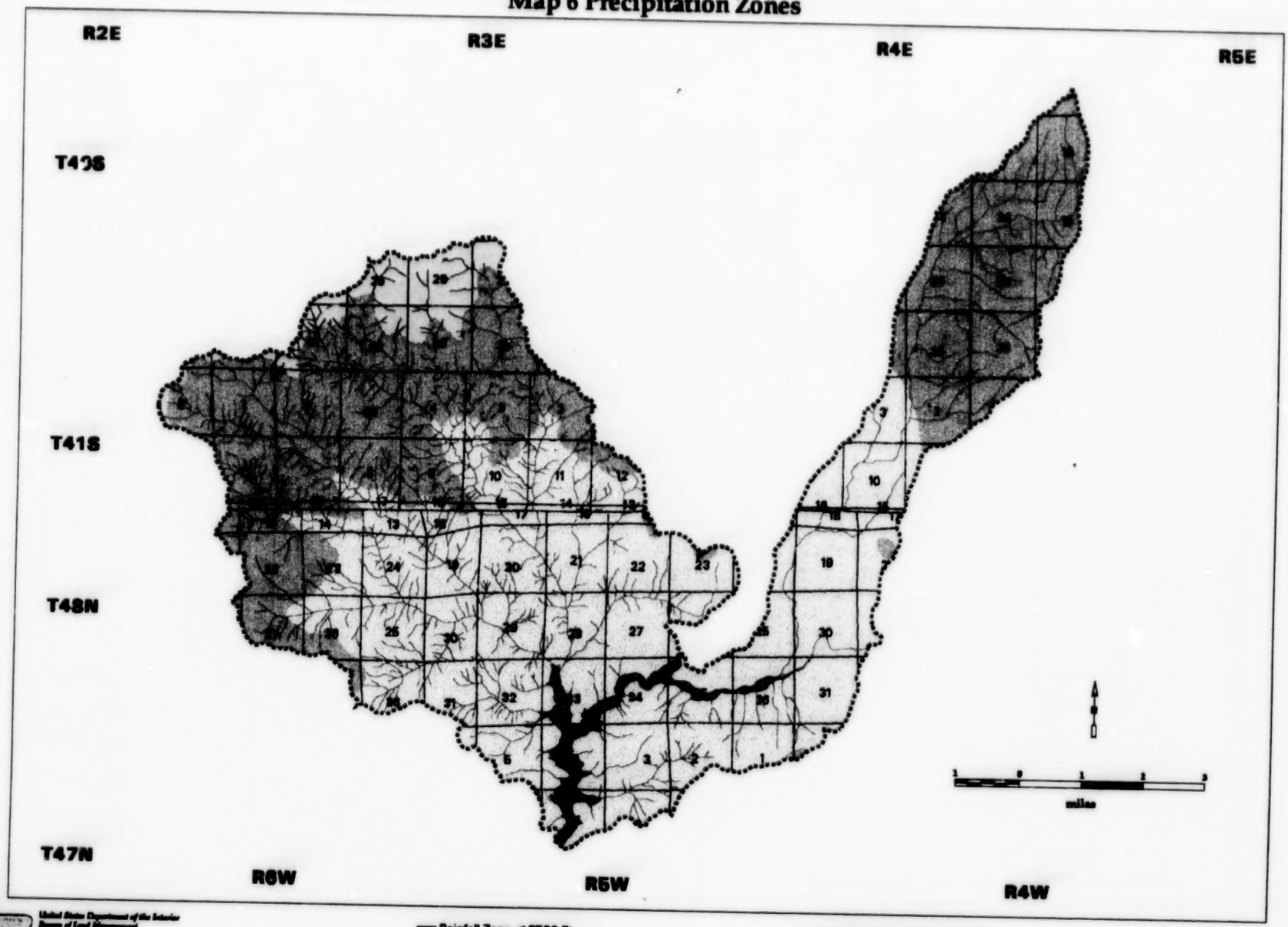
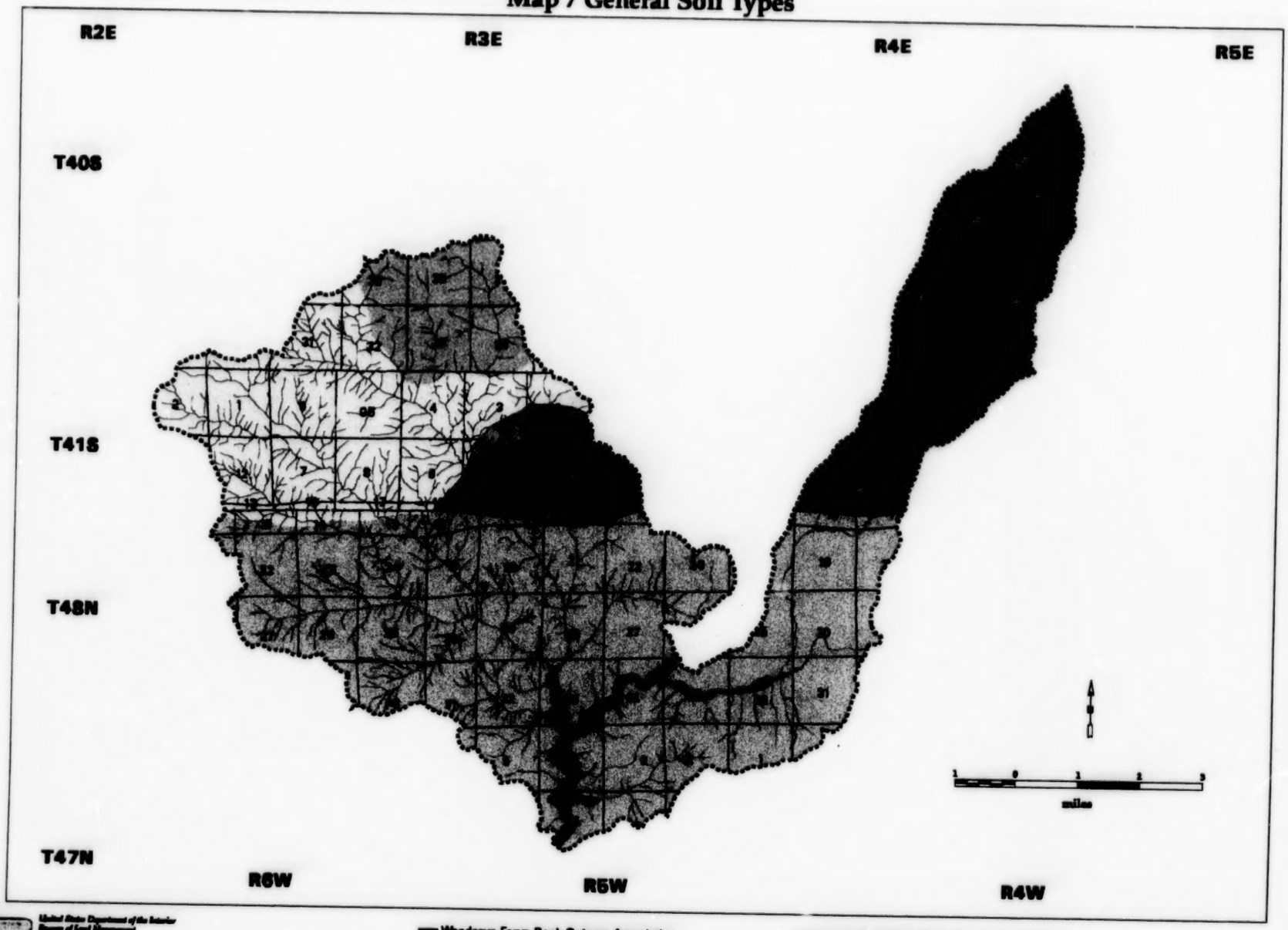
Klamath-Iron Gate Watershed
Map 6 Precipitation Zones



Map 6

Klamath-Iron Gate Watershed
Map 7 General Soil Types



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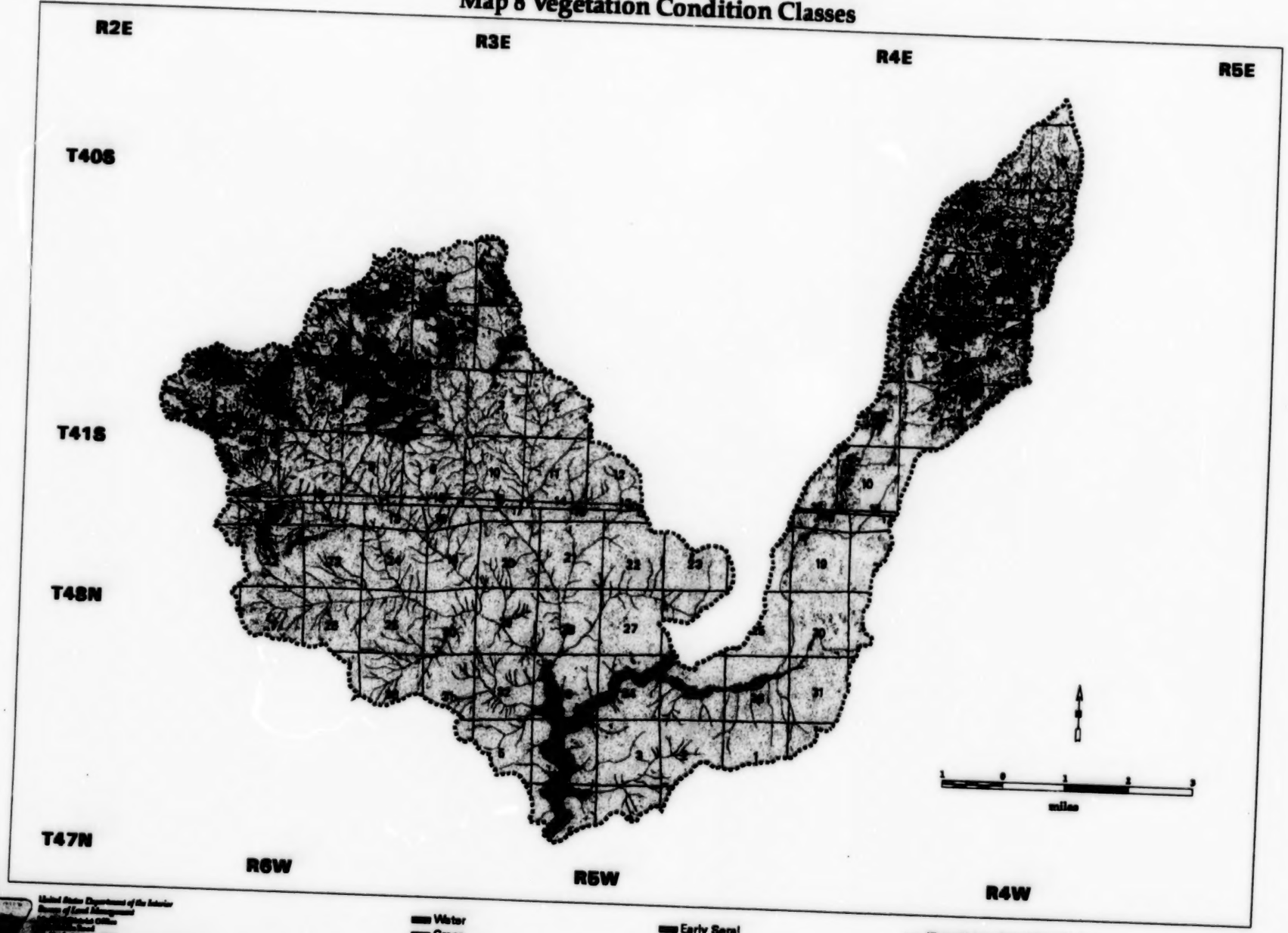
- Woodseye-Ferve-Rock Outcrop Association
- McMullin-Bogus-Happsie Association
- Skookum-Rock Outcrop-McMullin Association
- Ferve-Campfour-Peragon Association
- Lassen-Kuck-Mary-Rock Outcrop Association
- Iron Gate Reservoir
- Klamath-Iron Gate Watershed
- Stream

Map 7

Klamath-Iron Gate Watershed
Map 8 Vegetation Condition Classes



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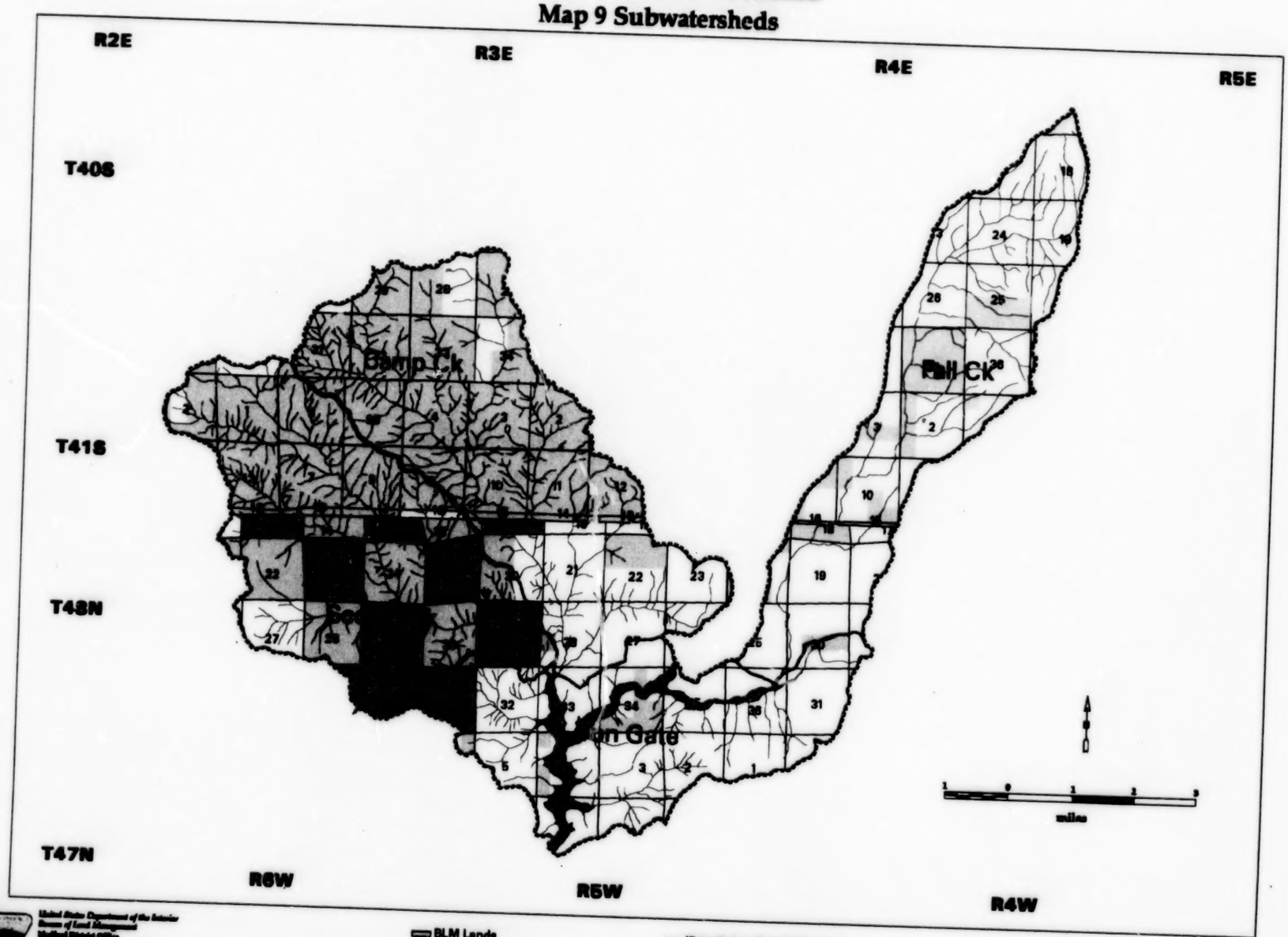
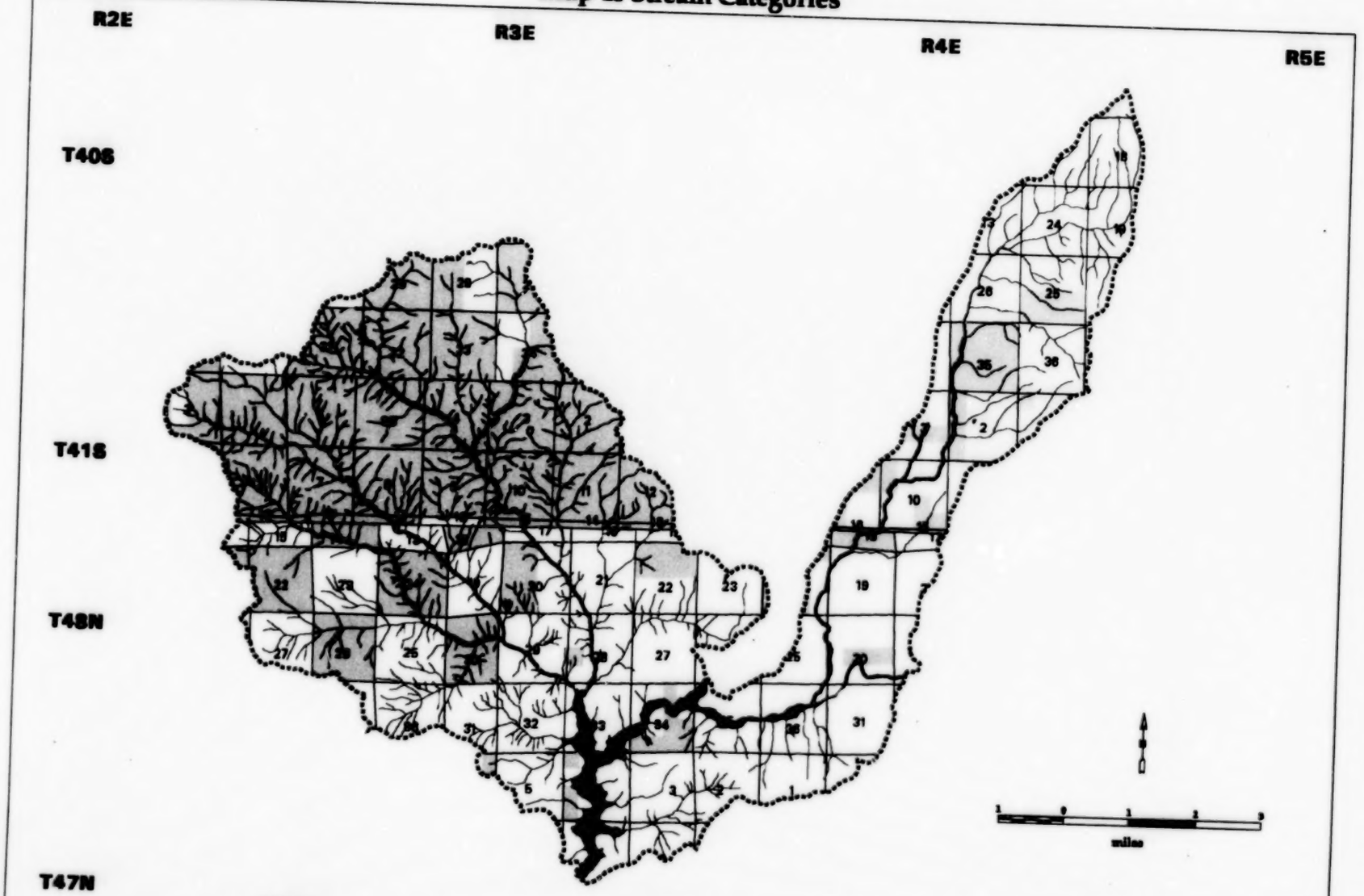
Map 8

Klamath-Iron Gate Watershed
Map 9 Subwatersheds



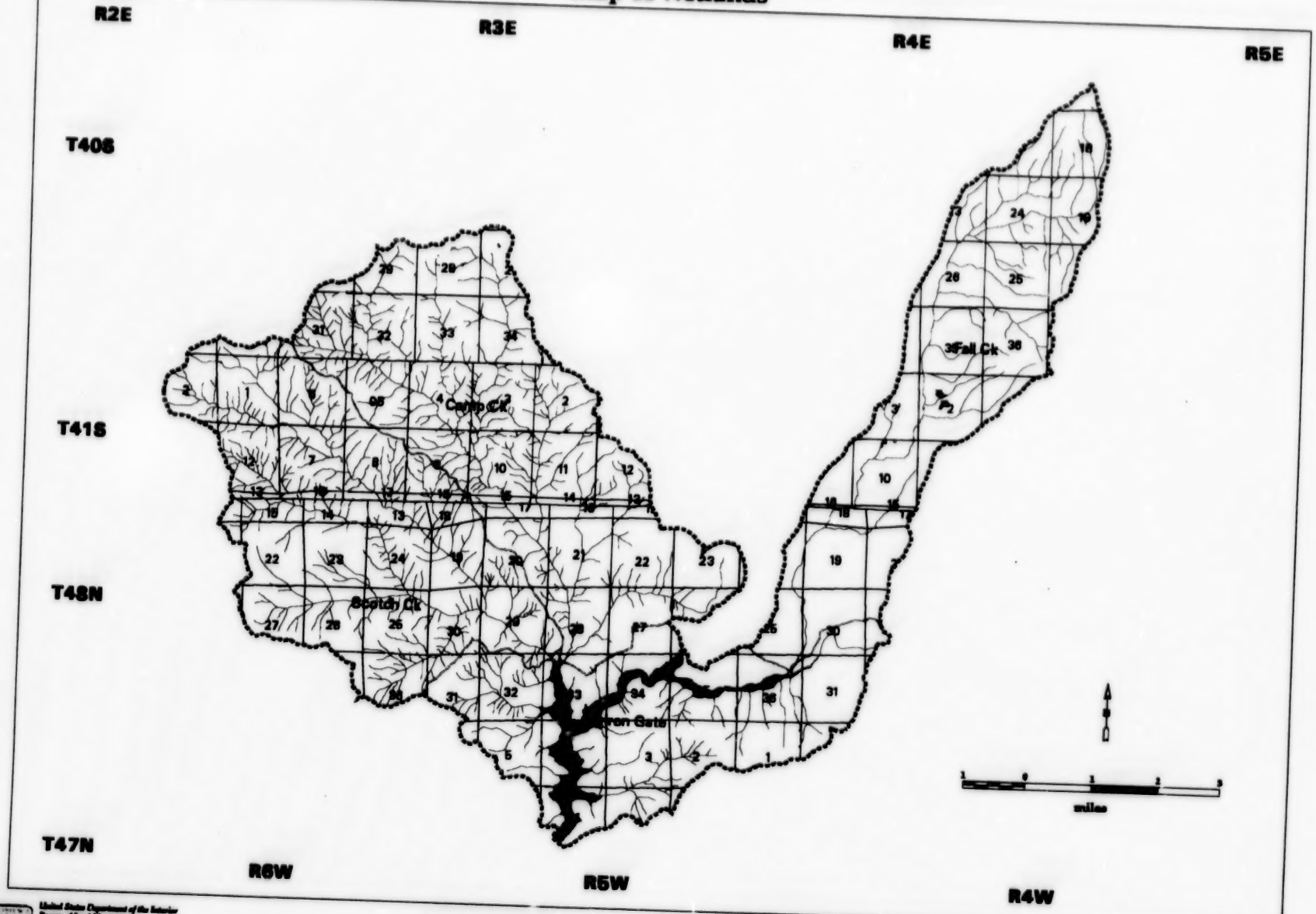
Map 9

Klamath-Iron Gate Watershed
Map 10 Stream Categories



Map 10

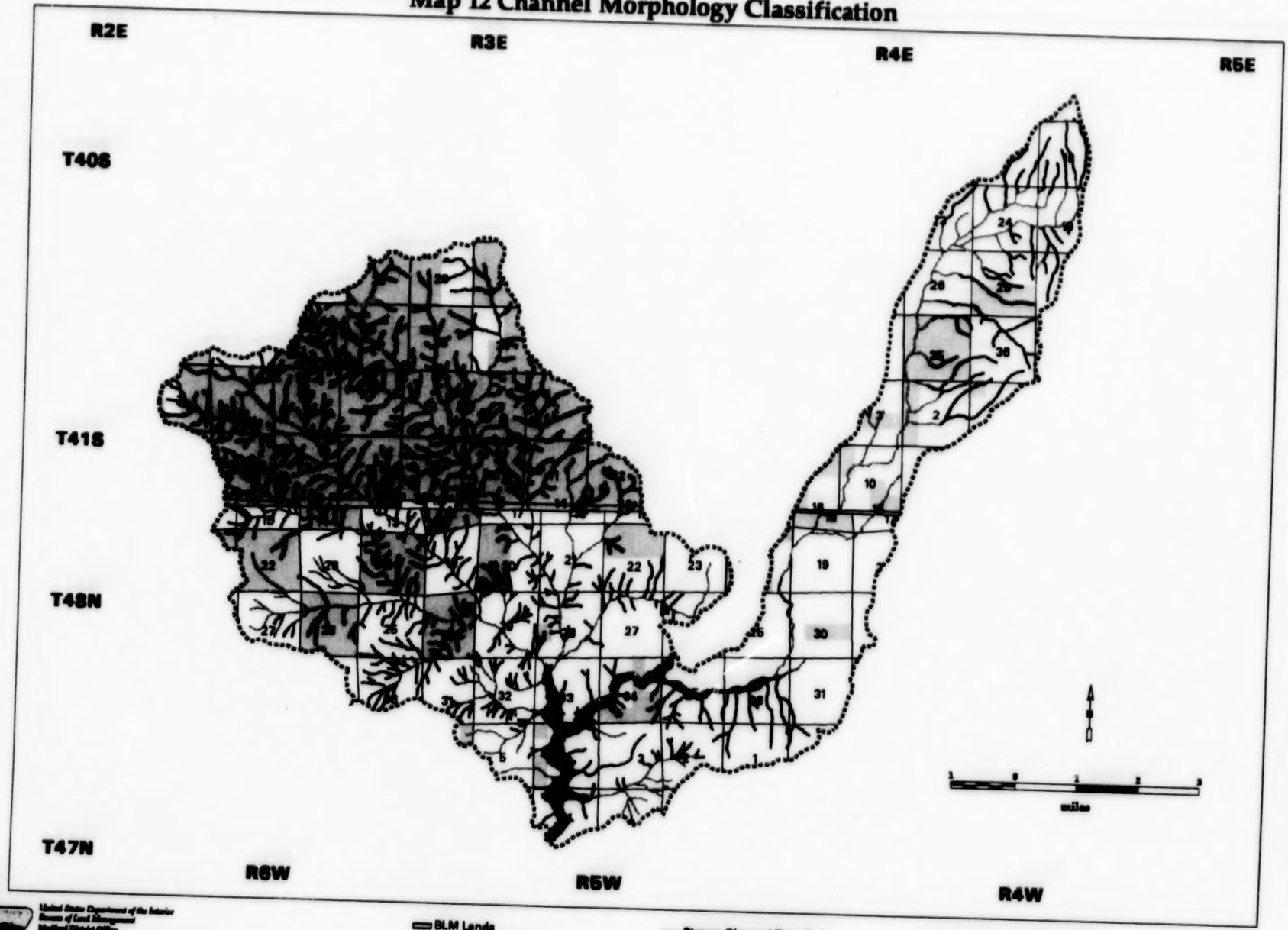
Klamath-Iron Gate Watershed
Map 11 Wetlands



Iron Gate Reservoir
Palustrine Wetland
Huc6 Subwatershed
Klamath-Iron Gate Watershed
Stream

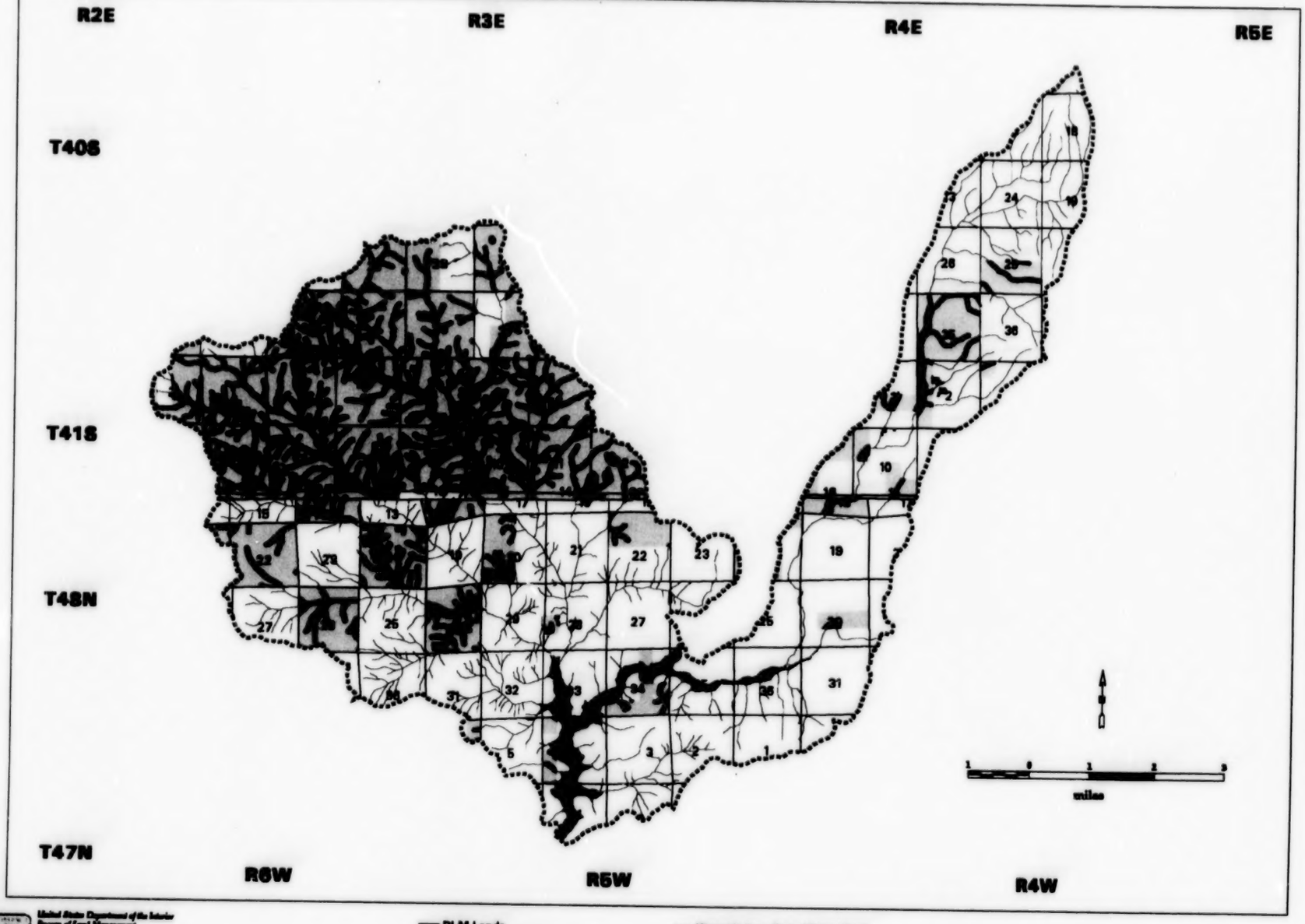
Map 11

Klamath-Iron Gate Watershed
Map 12 Channel Morphology Classification



Map 12

Klamath-Iron Gate Watershed
Map 13 Riparian Reserves



Map 13

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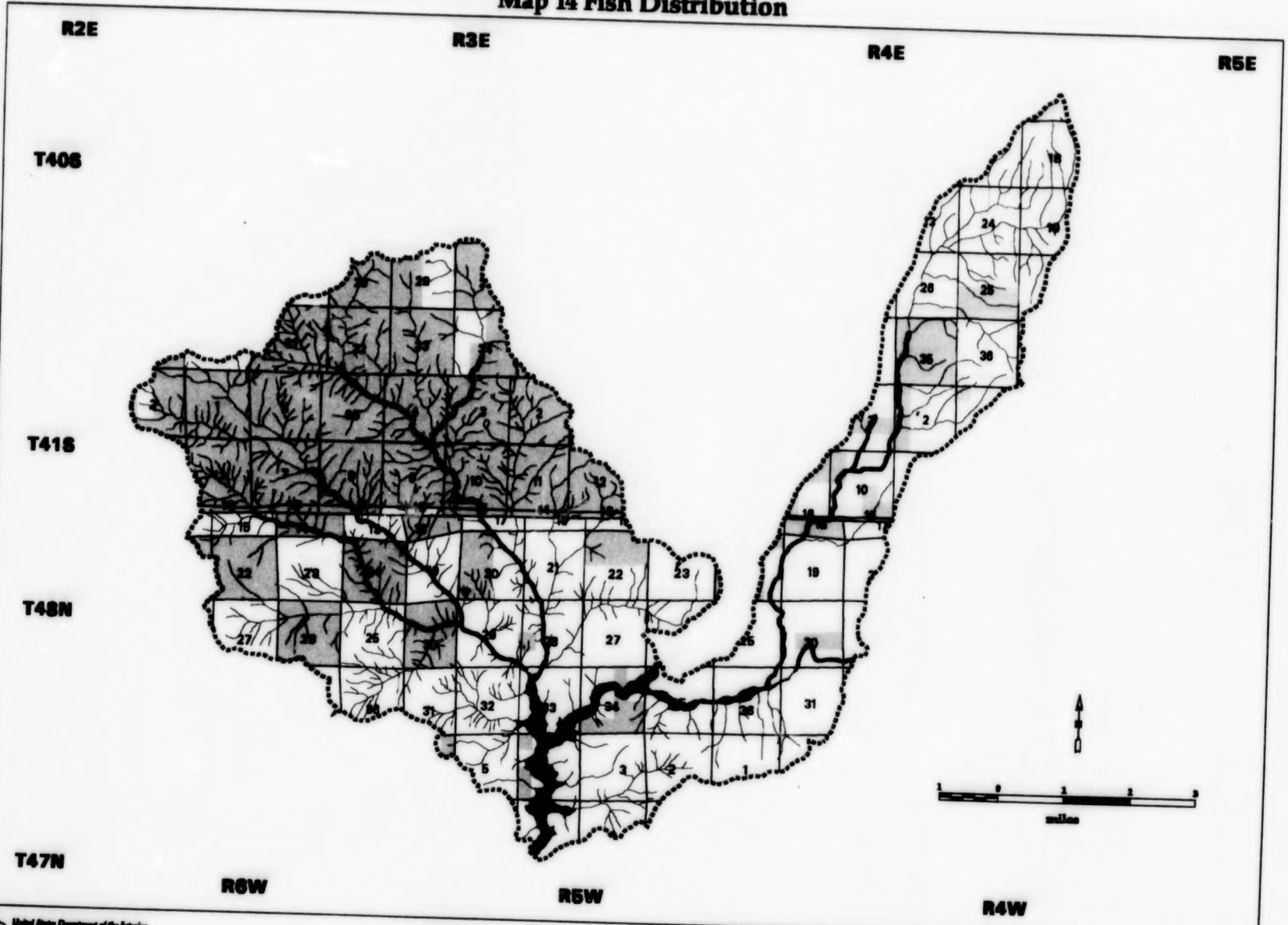
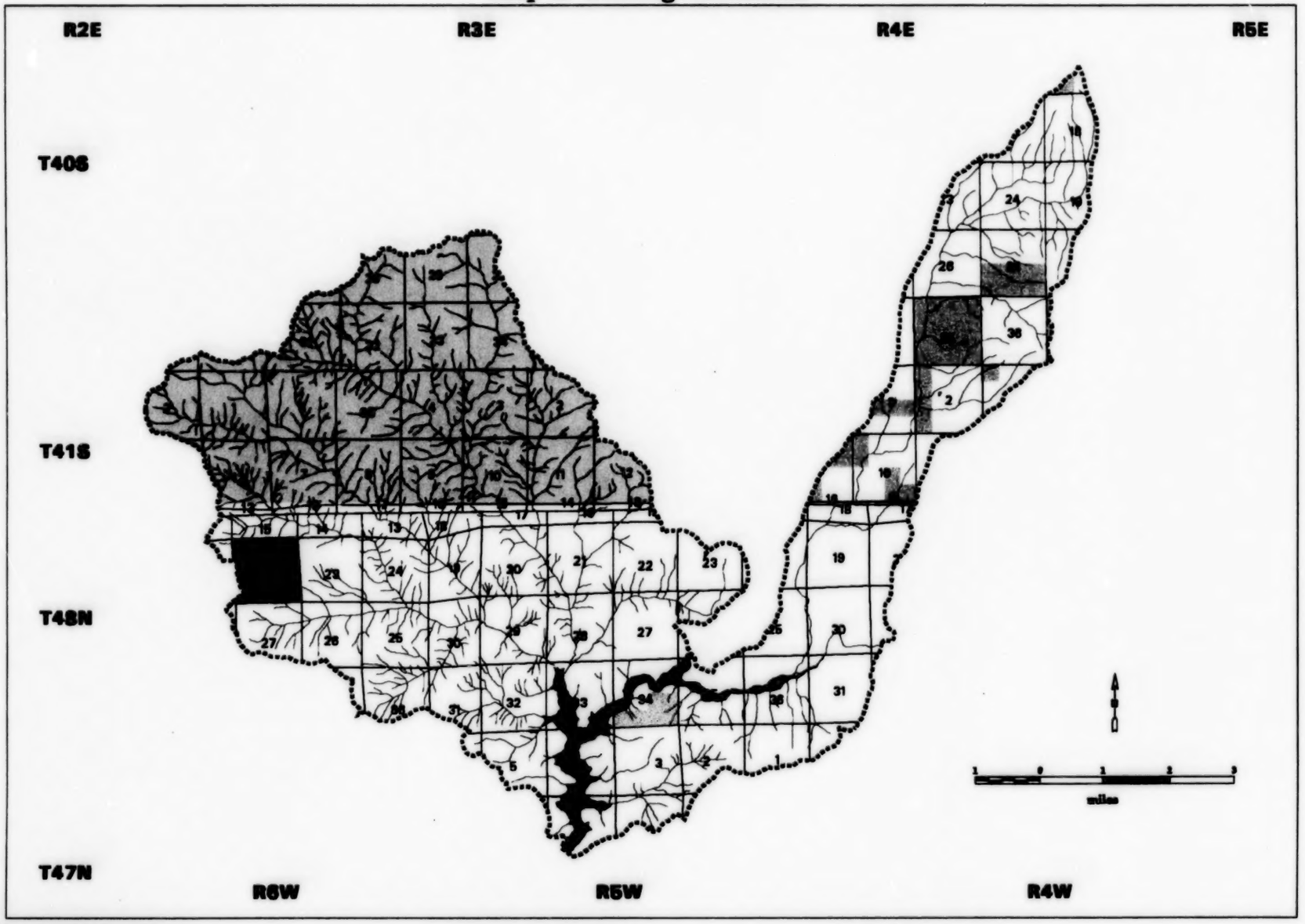
Klamath-Iron Gate Watershed
Map 14 Fish Distribution



Map 14

Klamath-Iron Gate Watershed
Map 15 Grazing Allotments



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Medford, Oregon 97504

Grazing Allotment OR10110
Grazing Allotment OR00156-01
Grazing Allotment OR00150-01
Grazing Allotment OR0107

Iron Gate Reservoir
Klamath-Iron Gate Watershed
Stream

Map 15

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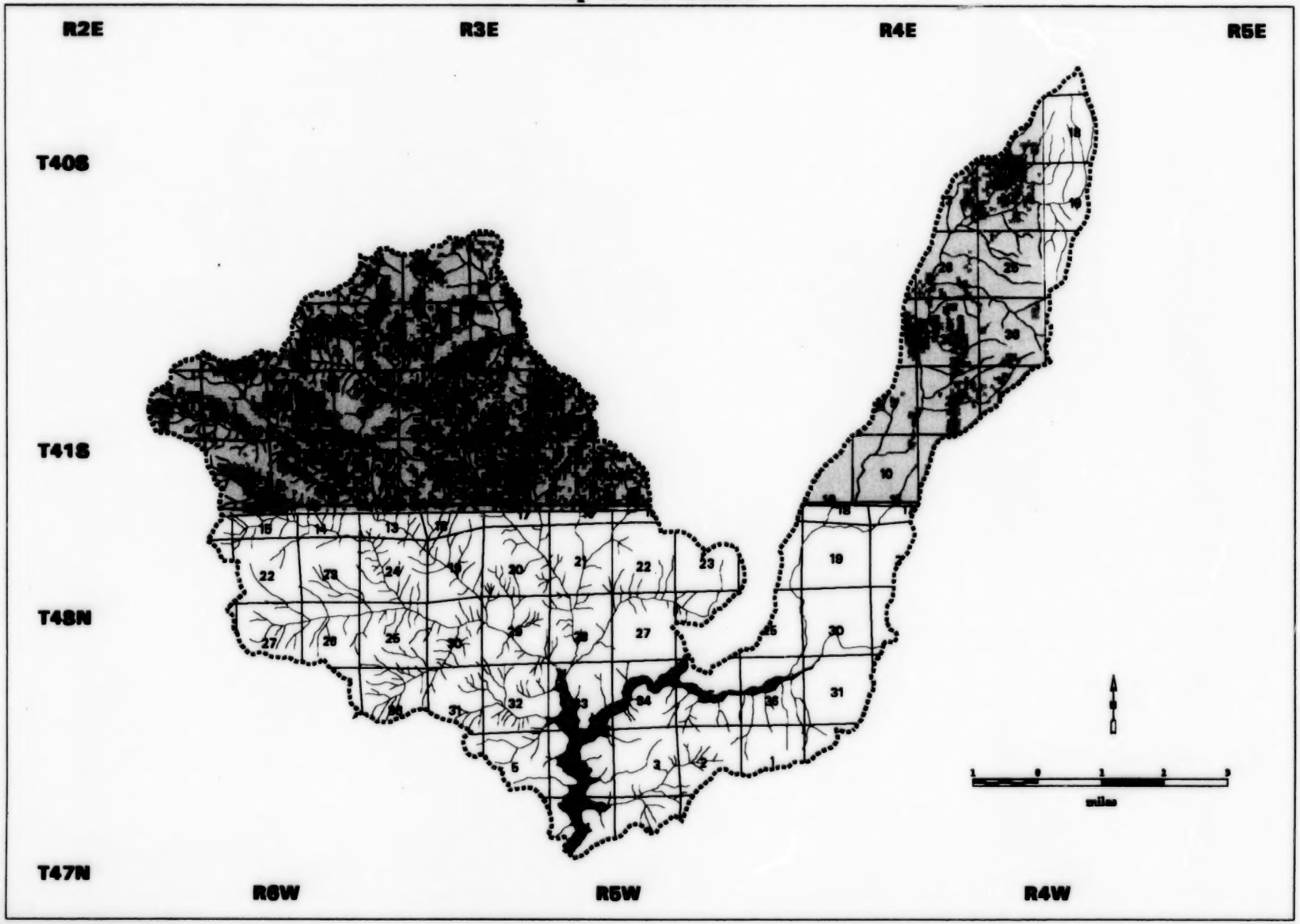
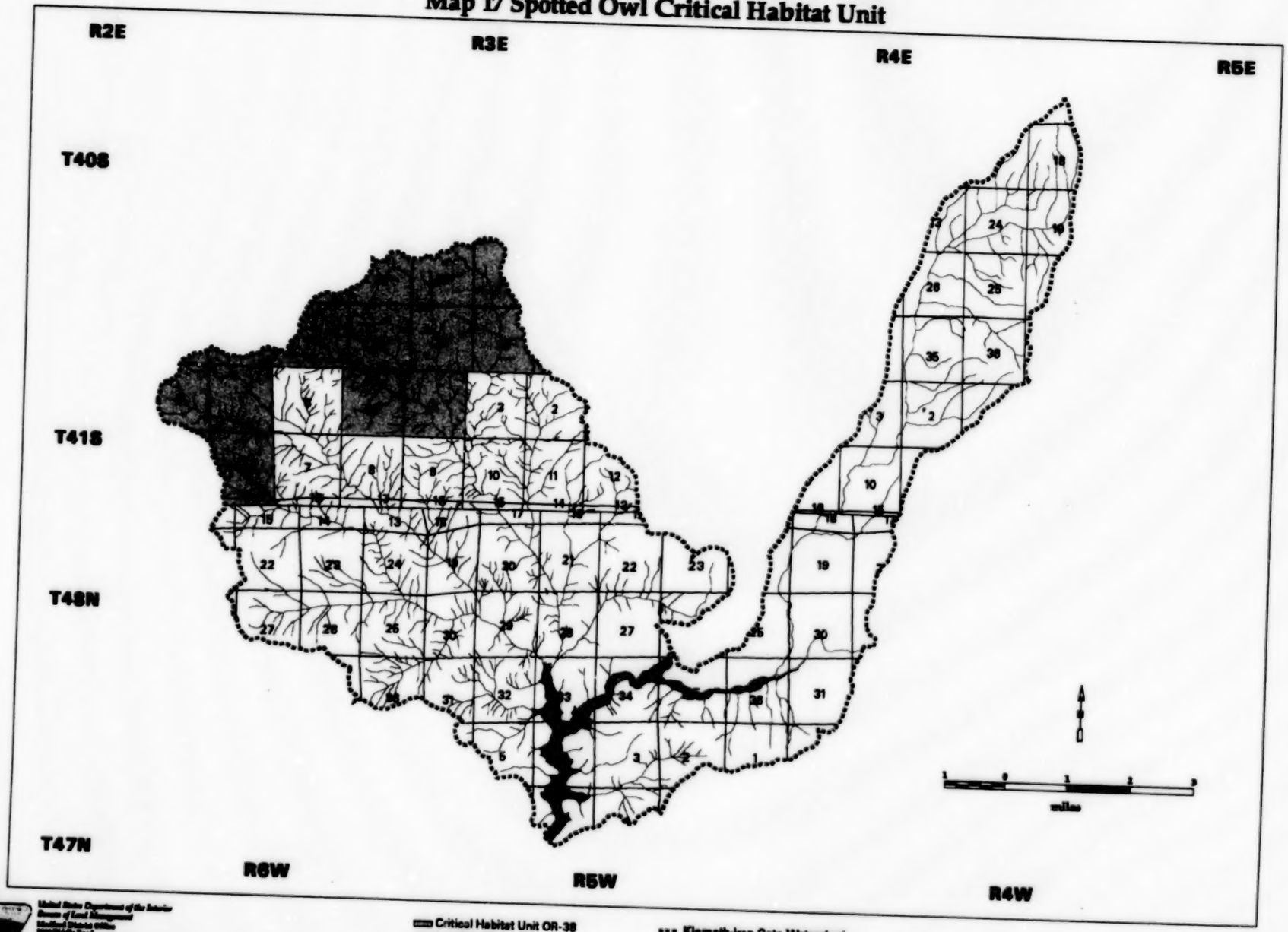
Klamath-Iron Gate Watershed
Map 16 Fire Hazard



Low Hazard Rating
Moderate Hazard Rating
High Hazard Rating
Iron Gate Reservoir
Klamath-Iron Gate Watershed
Stream

Map 16

Klamath-Iron Gate Watershed
Map 17 Spotted Owl Critical Habitat Unit



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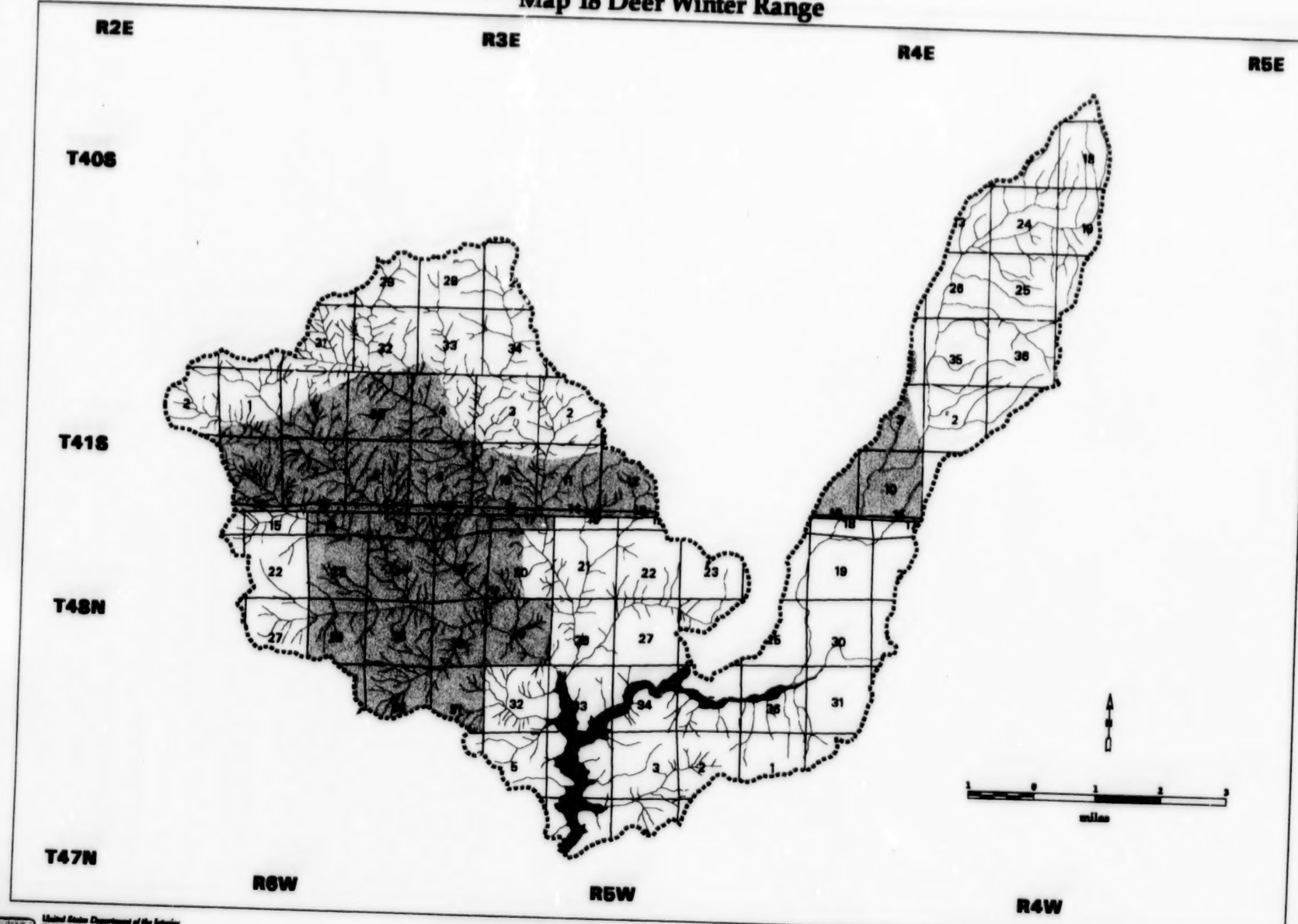
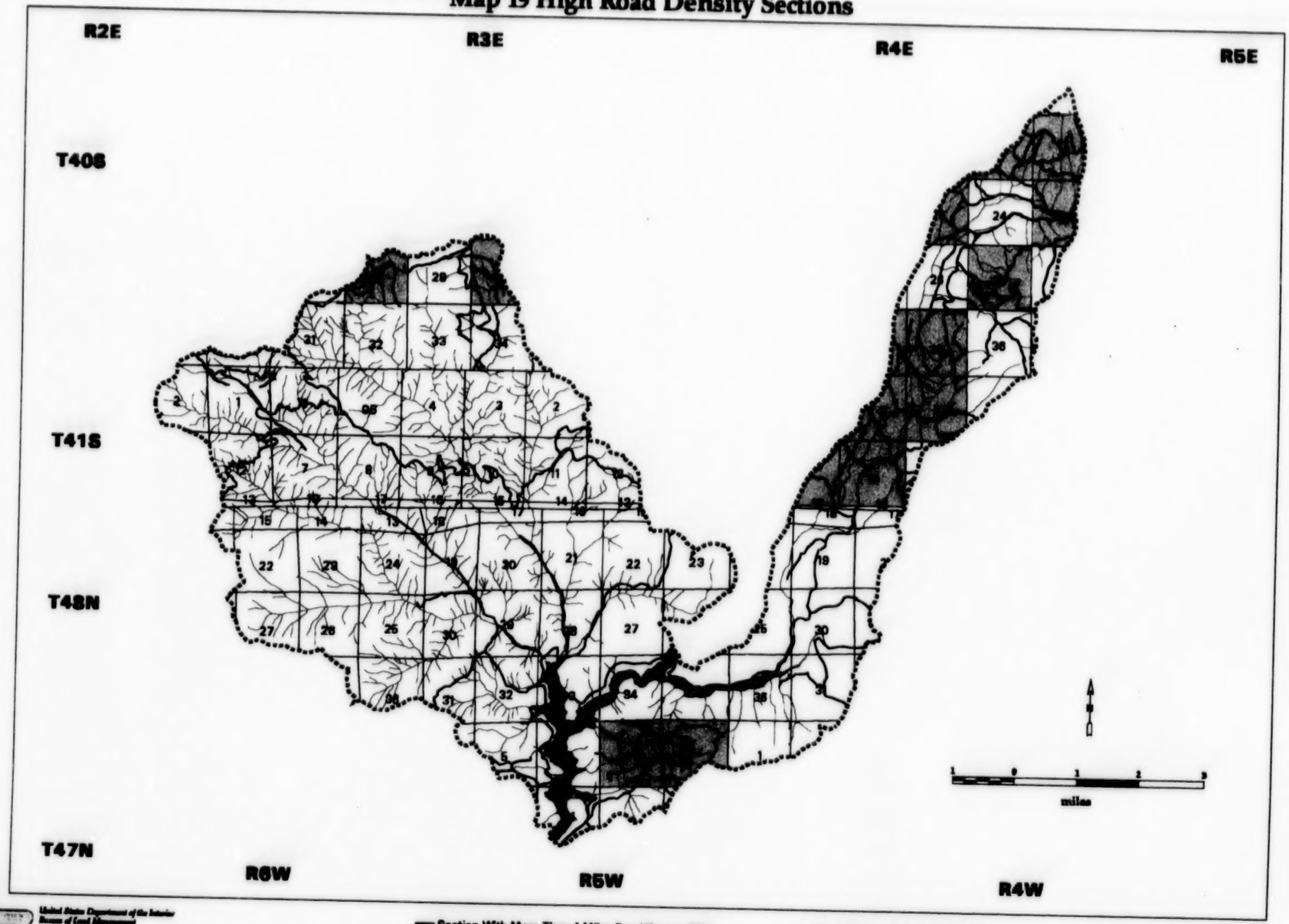
Map 17

Klamath-Iron Gate Watershed
Map 18 Deer Winter Range



Map 18

Klamath-Iron Gate Watershed
Map 19 High Road Density Sections



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Section With More Than 4 Miles Road/Square Mile
Iron Gate Reservoir
Klamath-Iron Gate Watershed
Stream
Road

Map 19

Created October 15, 1999 by lzoweda

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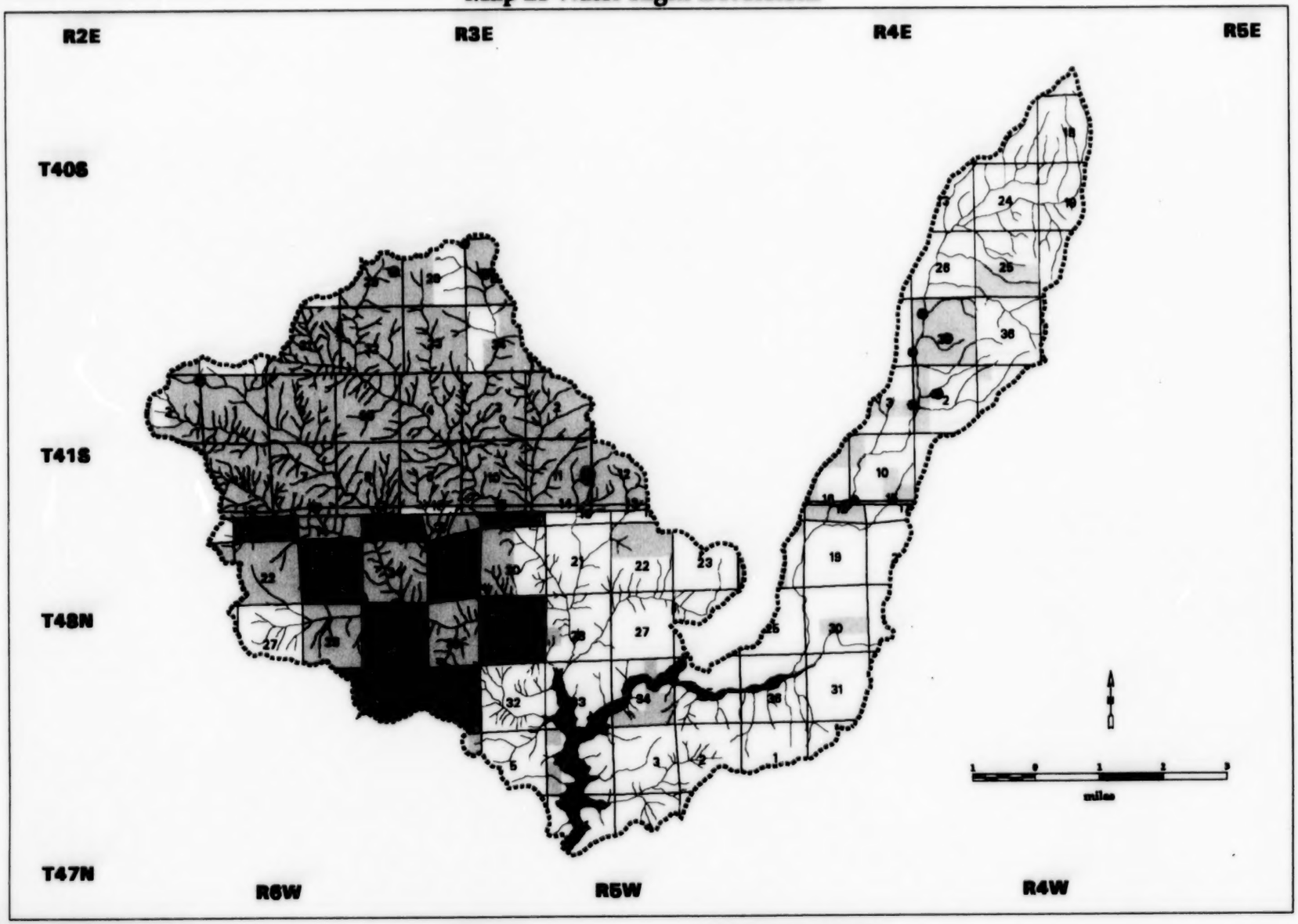
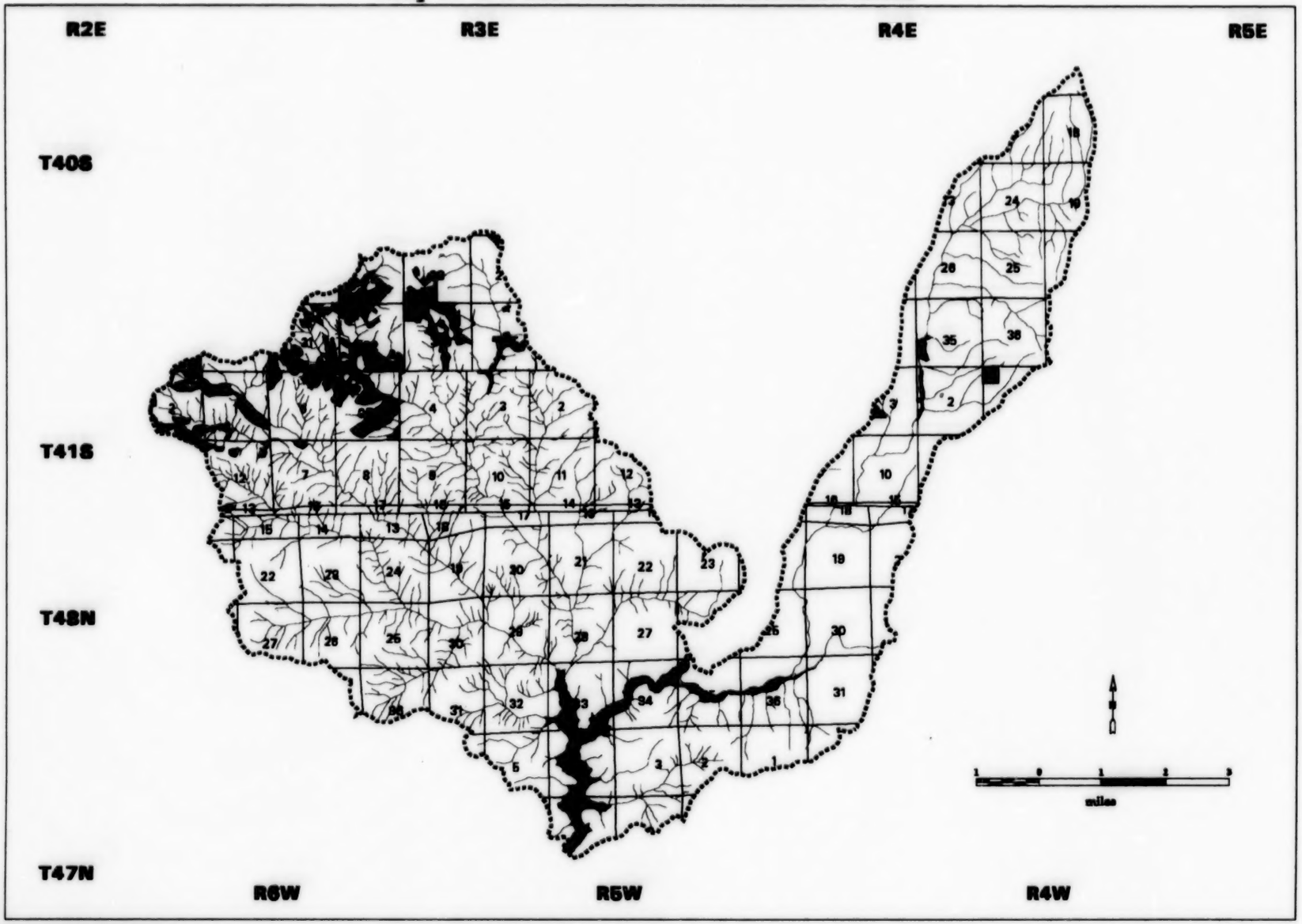
Klamath-Iron Gate Watershed
Map 20 Water Right Diversions



Map 20

Klamath-Iron Gate Watershed
Map 21 15% Late-Successional Retention Areas



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Late-Successional Retention Areas
Iron Gate Reservoir
Klamath-Iron Gate Watershed
Stream

Map 21

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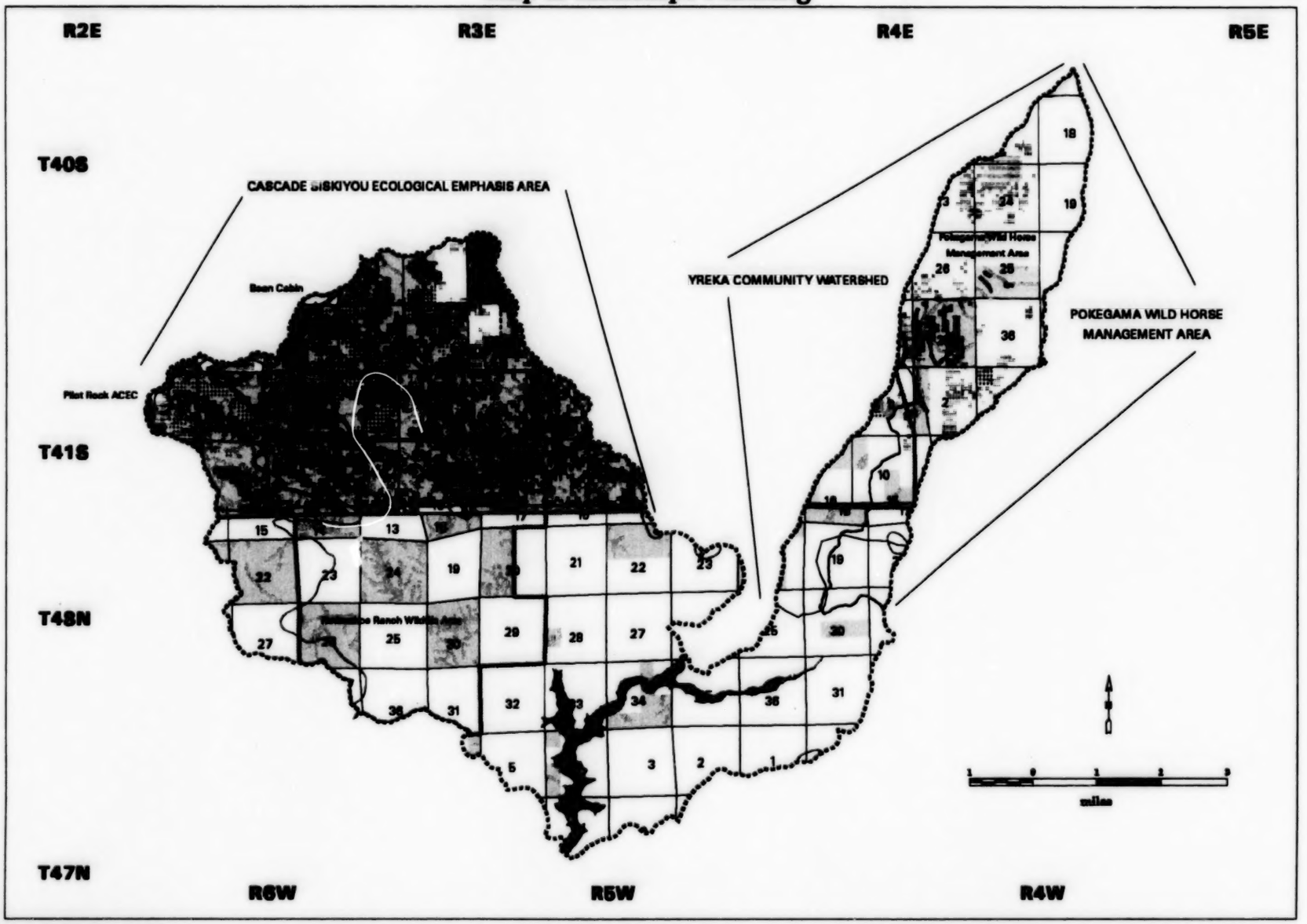
Klamath-Iron Gate Watershed
Map 22 Landscape Planning



District Defined Reserve
Matrix
Riparian Reserve
Iron Gate Reservoir
High Fire Hazard Areas
Late-Successional Retention Areas
Deer Winter Range
Transient Snow Zone
Scotch Creek Research Natural Area
Soda Mountain Wilderness Study Area
Proposed Road To Block or Decommission
Pacific Crest National Scenic Trail
Klamath-Iron Gate Watershed

Map 22

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Joe Hoppe	Facilities, Lands, and Minerals
Chris Johnson	Fire and Air Quality
Ted Hass	Geology, Erosion Processes, and Soil Productivity
James Heffner and Tom Jacobs	Grazing, Non-native Plants, and Noxious Weeds
Scott Haupt	Landscape Vegetation Pattern and Forest Density
Brad Tong	Plants and Special Areas
Fred Tomlins	Recreation and Wilderness Study Area
Bill Haight	Stream Channels, Riparian Areas, and Aquatic Wildlife
George Arnold	Terrestrial Wildlife
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Support Team Members	
Larry Zowada	GIS Maps and Information
Cori Frances	Logging Information
Frank Lang and Paul Hosten	Liaison with CSEEA Management Plan
David Leal	U.S. Fish and Wildlife Service Representative

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APPENDICES

APPENDIX A
Public Comments

Summary of Public Comments Recorded at Open House Meetings

Open house meetings were held at the Bogus Elementary School at Montague, California on April 20, 1999 and at the U. S. Forest Service Ashland Ranger District Office in Ashland, Oregon on April 21, 1999. A number of those attending the Ashland meeting had an interest in the Klamath-Iron Gate Watershed as well as the Upper Bear Creek Watershed Analysis Area.

The purpose of the meetings was to inform the public of the BLM's plans to prepare watershed analyses for the Klamath-Iron Gate Watershed and Upper Bear Creek Watershed Analysis Area, and to learn what concerns and issues were important to the public. The BLM was also seeking any information on the areas that may be new or pertinent for the analysis efforts. Attendees were asked to register so the BLM would have a list of names and addresses for future mailing. Registration forms indicated that there were thirty individuals at each meeting. The BLM staff members took notes on verbal comments. The following is a summary of those comments grouped by subject. These comments are in addition to those that were mailed to the BLM following the meetings.

Watershed

A resident who lived on the Klamath River downstream of Klamathon voiced concern about the safety of Pacificorp dams on the Klamath River in the event of an earthquake.

Mr. Dave Tanner, manager of the Fall Creek Water Project for the City of Yreka, requested a map showing the watershed boundary including ownerships, streams, roads, topography, etc. He indicated that he thought Jackson County had "honored" their request for a special designation for that portion of Fall Creek which they utilize for municipal purposes. (BLM followed-up with Jackson County Planning and found that the County has not taken any official action at this time).

One rancher commented that ranchers also have an interest in maintaining a healthy ecosystem, since their livelihood depends upon it.

Fish Resources

One long-time resident, a rancher, referred to George Wright's comments which implied that fish runs in local streams were much diminished after the 1920s, but there was good fishing for steelhead in Brush Creek, Dry Creek, Little Bogus, and Camp Creeks...maybe not as many as before but still numerous, with viable runs into the 1970s. Mountain trout were still up Camp Creek, also up Scotch creek, in pools above the falls. Jess Wright (George's brother ??) lived at the mouth of Camp Creek and had a fish weir and smokehouse. The 1964 flood

hit these streams hard. It took some years for the fish populations to re-establish themselves. After the Schoheim road was put in, those creeks were fished pretty hard.

Another gentleman from lower Camp Creek confirmed George Wright's report of historical use of Rock Creek (Camp Creek) by steelhead. Also assumed steelhead moved up Camp Creek to falls at the State line.

One gentleman added to our knowledge of the upstream limit of trout in Dutch Oven Creek and noted the location on a map.

Vegetation

A resident from Camp Creek Road has been pulling yellow starthistle on his property and wanted BLM to control these weeds on ownerships adjacent to his. Others asked about controlling noxious weeds in general and showed interest in what government agencies in Oregon and California were doing.

One gentleman wanted to know why we do not manage the forest like we used to. He thought it was better to grow trees close together so they would grow straight and tall, without any lower limbs, which makes better lumber.

Earlier vegetation, according to one rancher, was generally more open. Now there is more, dense vegetation rather than fewer, bigger trees. He believes that the increase or changes in vegetation are responsible for lower water flows in streams. He stated that the rainfall, as measured at Copco for almost 100 years, has not changed, but the vegetation has.

Pacific Crest Trail

One individual offered that the BLM's proposal to develop a shelter and horse corals at the Bean Cabin site will draw increased horse and vehicle traffic, and increase the use in the area which would degrade the environment.

History

A resident on Camp Creek Road said Camp Creek was once called Beaver Creek.

A long-time resident in the Montague area stated that it was originally hoped that the Copco and Klamath Railroad would be the mainline from Yreka to Klamath Falls, but then it went through McDoel/Doris. The train was used for timber and passengers, but then the mill at Klamathon burned. The rail line was out of use for a while, then Copco bought it and used it to haul materials in for the dam, though the line was in bad shape by then. The remains of the line were sold for scrap metal during World War II.

Watershed Planning Process

Regarding public meetings, one individual stated that its is difficult for "the public", working

for free, to present their interests, especially when there are those that are well funded and paid to represent certain issues.

One lady said that all agencies who have responsibilities for an area affecting the people who live there should be attending an open house because it is difficult and confusing having multiple authorities with different policies.

There was some criticism about maps provided at the open house because roads were not correct, particularly in the Camp Creek area. One man wanted a "real" organized meeting including the Redding BLM staff and Al Gore.

Several people had a different expectation of the open house format. They expected formal presentations by the BLM and an opportunity for the public to speak in front of all those attending the open house.

Summary of Written Public Comments Received

Approximately 1,200 fliers were sent to residents and interested parties in the Klamath-Iron Gate and Upper Bear Analysis Areas announcing dates and locations for open house meetings. The fliers also invited the recipients to send written comments to the BLM concerning issues and management direction. In addition, response forms were provided at open house meetings to encourage individuals to mail comments following the meetings. The BLM received 94 written comments plus over 300 form letters which are summarized below.

Most of the comments discussed roads and off-highway vehicle (OHV) use. Sixty-six letters, mostly from OHV club members, favored keeping roads open for OHV use, especially the Schoheim Road. One letter emphasized that roads should be kept open for physically disabled people. Another suggested that if BLM decided to close roads with locked gates that a "key check-out" program could be implemented.

Nineteen letters and the 300 plus form letters supported closing unsurfaced roads in the analysis area. The main reasons expressed were to protect water quality, prevent fires caused by OHVs, and protect wildlife. The Schoheim Road was particularly targeted by these comments. Some comments encouraged land managers to protect the watershed from logging as well as OHVs. Some were more specific concerning erosion from roads.

Some letters said the area should be designated as a wilderness, while others stated that the area should be managed for multiple use. Only three letters commented about livestock grazing. One said BLM should provide for more, while the other two asked for reductions in livestock numbers. The control of noxious weeds was a concern in a few letters.

One letter suggested that because of the increase in population in Southern Oregon there is a greater need to set aside more areas for a wilderness experience. Other comments talked about the diverse array of ecology, climate, geology and biology that the analysis area offers and the ecological integrity of the area.

A few letters addressed the process used by the BLM to develop the watershed analysis. One writer liked the process being used. Another said the open house held at Bogus Elementary School was poorly attended, and suggested that land management should be left to the people in the area. Another writer suggested that the BLM land should revert back to the Homestead Act.

APPENDIX B
Noxious Weeds

[illegible]	[illegible]	[illegible]
Yellow starthistle	*Centaurea solstitialis*	Annual that will germinate in fall, spring, or winter. It blooms from July through September. This species is aggressive and spreads rapidly. Horses feeding on the plant can develop "chewing disease", which can be fatal. Biological agents have been released on the district: seed fly (Urophora sirunaseva) - 1985, seed weevil (Bangasternus orientalis) - 1987, and Yellowstar Flower weevil (Laurinus curtus) - 1998.
St. Johnswort (Klamath Weed)	*Hypericum perforatum*	This plant causes photosensitization in light colored animals, with young being particularly susceptible. Although seldom fatal, economic losses can easily occur. Cattle and sheep normally will not consume this plant when mature, but young shoots in the spring may be eaten. Biological control agents have been very successful for this plant.
Medusahead wildrye	*Taeneatherum asperum*	Annual grass that can cause mechanical injury to grazing animals due to its stiff, sharp awns; and can form a carpet on the soil surface which can interfere with germination of perennial grasses.

[illegible]	[illegible]	[illegible]
Purple starthistle	*Centaurea calcitrapa*	Biennial that can act as an annual or short-lived perrenial that blooms June through September. Seeds germinate in spring and/or fall. Extremely competitive. Small infestations in Jackson County are believed to be eradicated, but infestations in Northern California are a constant threat.
Diffuse knapweed	*Centaurea diffusa*	Biennial, single stemmed plant with numerous lateral branches. Forms dense stands on any open ground and will readily exclude other plants.
Spotted knapweed	*Centaurea maculosa*	Biennial or short-lived perennial which flowers from June to October. Occurs along roads and in range areas. Erect, one to three feet high with purple flowers.
Squarrose knapweed	*Centaurea virgata v. squarrosa*	Perennial. Seed heads are deciduous and fall off the stems soon after seeds mature. Readily colonizes disturbed soils. Reported along I-5 in northern California.

Noxious Weeds in Adjacent Watersheds That Pose Threats to Klamath-Iron Gate Watershed		
Common Name	Scientific Name	Description
Canada thistle	*Cirsium arvense*	Creeping perennial that is difficult to control because of its aggressive nature and extensive root system, from which it can asexually reproduce. Canada thistle stems are smooth instead of spiny and "winged" as are the stems of Scotch or Bull thistles.
Dodder	*Cuscuta sp.*	Parasitic plant identified using Ceanothus cuneatus as a host. The small root system disappears once the pland becomes established on a host. Seeds are long lived and infestations may occur in areas where host plants have not grown for several years. Reports of Dodder near Pilot Rock and Agate Flat.
Leafy spurge	*Euphorbia esula L.*	Perennial which reproduces by root stalks as well as seed. This plant has a milky sap that causes severe irritation of the mouth and digestive tract. Sighted along Bear Creek.
Dyers woad	*Isatus tinctoria L.*	Winter annual, biennial, or short-lived perennial from Europe. Its thick tap root may exceed 5 feet in depth. "Pulling" or "topping" are ineffective mechanical controls as it can regenerate from roots. Recorded along Jenny Creek its tributaries.
Dalmation toadflax	*Linaria genistfolia ssp. dalmatica*	Perennial reproducing by seed and root stalks. It has a deep, extensive root system and waxy leaves. Found along roadsides and disturbed soils. Reported in Mayfield Gardens.
Tansy ragwort	*Senecio jacobaea L.*	Annual member of the aster family is a poisonous Eurasian weed that can cause livestock losses. Reproduces through seed. Biological control through the cinnibar moth, ragwort seed fly and flea beetle. Found west of Cascades.

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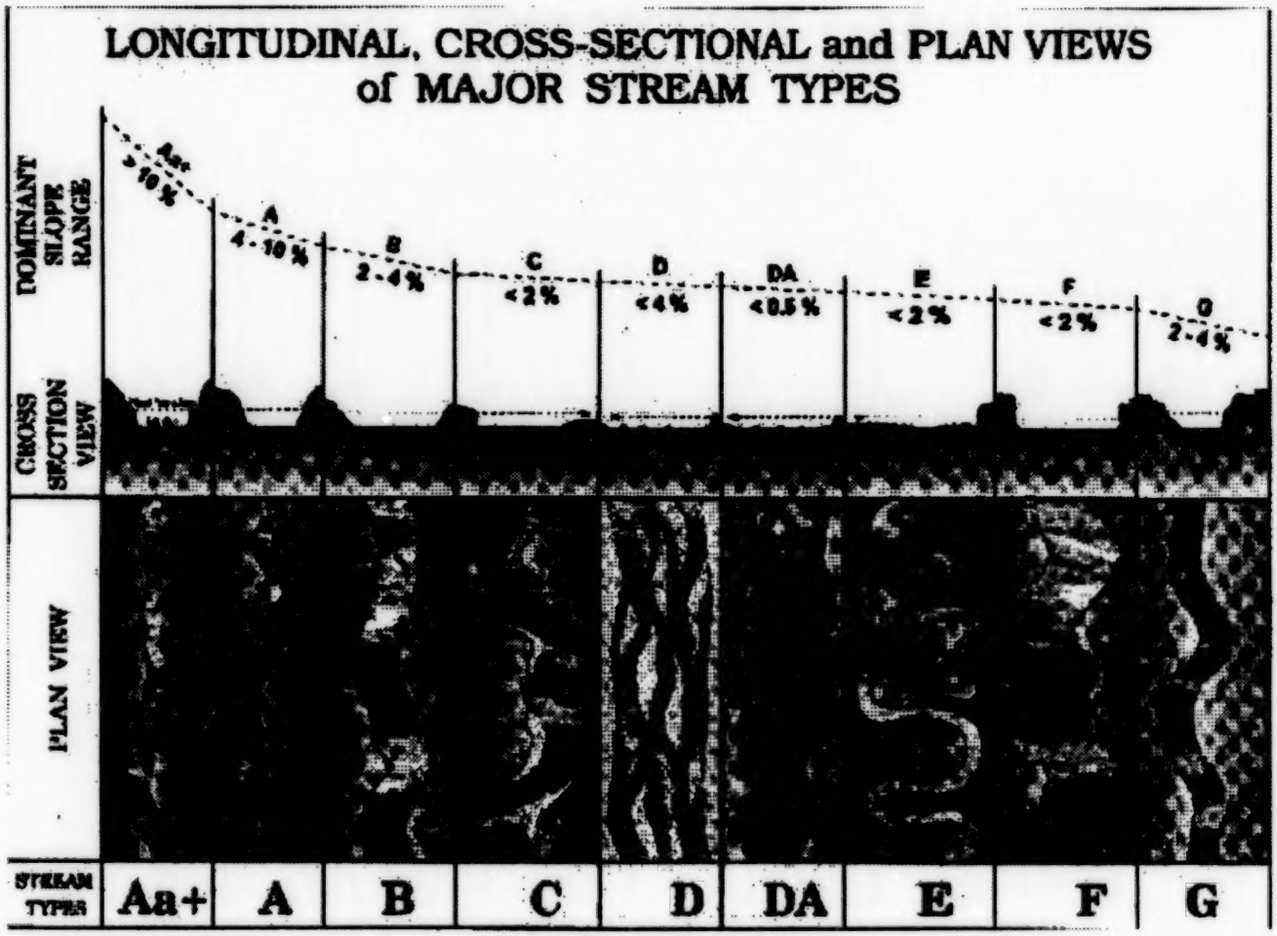
APPENDIX C
Channel Morphology Classification

Broad-Level Stream Classification Delineation (Rosgen 1994)



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General Stream Type Descriptions for Broad-Level Classification (Rosgen 1996)

Stream Type	General Description	Entrenchment Ratio	W/D Ratio	Sinuosity	Slope	Landform/ Soils/Features
A a+	Very steep, deeply entrenched, debris transport, torrent streams.	<1.4	<12	1.0 to 1.1	>.10	Very high relief. Erosional, bedrock or depositional features; debris flow potential. Deeply entrenched streams. Vertical steps with deep scour pools; waterfalls.
A	Steep, entrenched, cascading, step/pool streams. High energy/debris transport associated with depositional soils. Very stable if bedrock or boulder dominated channel.	<1.4	<12	1.0 to 1.2	.04 to .10	High relief. Erosional or depositional and bedrock forms. Entrenched and confined streams with cascading reaches. Frequently spaced, deep pools in associated step/pool bed morphology.
B	Moderately entrenched, moderate gradient, riffle dominated channel, with infrequently spaced pools. Very stable plan and profile. Stable banks.	1.4 to 2.2	>12	>1.2	.02 to .039	Moderate relief, colluvial deposition, and/or structural. Moderate entrenchment and W/D ratio. Narrow, gently sloping valleys. Rapids predominate w/scour pools.
C	Low gradient, meandering, point-bar, riffle/pool, alluvial channels with broad, well defined floodplains.	>2.2	>12	>1.4	<.02	Broad valleys w/terraces, in association with floodplains, alluvial soils. Slightly entrenched with well-defined meandering channels. Riffle/pool bed morphology.
D	Braided channel with longitudinal and transverse bars. Very wide channel with eroding banks.	n/a	>40	n/a	<.04	Broad valleys with alluvium, steeper fans. Glacial debris and depositional features. Active lateral adjustment, w/abundance of sediment supply. Convergence/divergence bed features, aggradational processes, high bedload and bank erosion.
DA	Anastomosing (multiple channels) narrow and deep with extensive, well vegetated floodplains and associated wetlands. Very gentle relief with highly variable sinuosities and width/depth ratios. Very stable streambanks.	>2.2	Highly variable	Highly variable	<.005	Broad, low-gradient valleys with fine alluvium and/or lacustrine soils. Anastomosed (multiple channel) geologic control creating fine deposition w/well-vegetated bars that are laterally stable with broad wetland floodplains. Very low bedload, high wash load sediment.
E	Low gradient, meandering riffle/pool stream with low width/depth ratio and little deposition. Very efficient and stable. High meander width ratio.	>2.2	<12	>1.5	<.02	Broad valley/meadows. Alluvial materials with floodplains. Highly sinuous with stable, well-vegetated banks. Riffle/pool morphology with very low width/depth ratios.
F	Entrenched meandering riffle/pool channel on low gradients with high width/depth ratio.	<1.4	>12	>1.4	<.02	Entrenched in highly weathered material. Gentle gradients, with a high width/depth ratio. Meandering, laterally unstable with high bank erosion rates. Riffle/pool morphology.
G	Entrenched "gully" step/pool and low width/depth ratio on moderate gradients.	<1.4	<12	>1.2	.02 to .039	Gullies, step/pool morphology w/moderate slopes and low width/depth ratio. Narrow valleys, or deeply incised in alluvial or colluvial materials, i.e., fans or deltas. Unstable, with grade control problems and high bank erosion rates.

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APPENDIX D
Grazing Use on BLM-Administered Lands

1999 Klamath-Iron Gate Watershed Analysis for BLM-Administered Lands				
Allotment (Name and Number)	Percentage[1] of Allotment in Analysis Area	Acres of Allotment in Analysis Area (BLM)	Permitted Use (AUMs[2])	Season of Use
Soda Mountain[3] 10110	34	11,964	1,794	5/1 to 10/15
Dixie[4] 10111	31	1,734	415	5/15 to 9/15

1/ Estimated
2/ AUMs = animal unit months
3/ Managed by Ashland Resource Area, Medford District
4/ Managed by Klamath Falls Resource Area, Lakeview District

1999 Klamath-Iron Gate Watershed Analysis for BLM-Administered Lands (Continued)				
Allotment (Name and Number)	Percentage[1] of Allotment in Analysis Area	Acres of Allotment in Analysis Area (BLM Acres)	Permitted Use (AUMs[2])	Season of Use
Fitzgerald Lease[1] 00150	100	240	18	4/16 to 6/15
Lemos Lease[1] 00156	100	760	71	4/15 to 6/16

1/ Estimated
2/ AUMs = animal unit months
3/ Grazing leases are within the Redding Field Office, Ukiah District, but administered by the Medford District due to access.

APPENDIX E
Introduced Plant Species

Introduced Plant Species in the Klamath-Iron Gate Watershed		
Introduced Plant Species	**Common Name**	**Scientific Name**
Annual Grasses	Ripgut Brome*	*Bromus rigidus*
	Medusahead Wildrye*	*Taeneantherum asperum*
	Hedgehog Dogtail*	*Cynosurus echinatus*
	Cheatgrass	*Bromus tectorum*
Perennial Grasses	Bulbous Bluegrass	*Poa bulbosa*
	Kentucky Bluegrass	*Poa pratensis*
	Canada Bluegrass	*Poa compressa*
	Intermediate Wheatgrass	*Agropyron intermedium*
	Pubescent Wheatgrass	*Agropyron trichophorum*
Forbs	Filaree	*Erodium circutorium*
	Common St. Johnswort*	*Hypericum perforatum*
	Common Dandelion	*Taraxacum officinale*
	English Plantain	*Platago lanceolata*
	Yellow Starthistle*	Centaurea solstitialis

*Noxious weeds

APPENDIX F
Road Densities > 4.0 mi/sq. mi. and/or Road/Stream Intersections > 10/sq. mi.

Township	Range	Section	Road Density (mi/sq. mi.)	Stream Crossings (#/sq. mi.)	Near Unstable Area? (Y/N)
Fall Creek Subwatershed					
40S	4E	13	5.2	8	N
40S	4E	23	4.6	7	N
40S	4E	25	5.3	9	N
40S	4E	34	4.5	0	N
40S	4E	35	5.1	14	N
40S	4E	36	2.5	20	N
40S	5E	18	5.1	17	Y
40S	5E	19	4.4	8	N
41S	4E	2	4.3	11	N
41S	4E	3	4.7	6	N
41S	4E	9	4.8	0	N
41S	4E	10	4.1	5	N
Camp Creek Subwatershed					
40S	3E	27	5.4	4.0	N
40S	3E	29	6.8	8.0	N
Scotch Creek Subwatershed					
41S	2E	1	3.4	14	N
41S	2E	12	2.6	13	N
41S	3E	6	3.4	11	N
Iron Gate Subwatershed					
47N	5W	2	5.4	13	N
47N	5W	3	6.4	13	N

APPENDIX G
Stream Habitat Survey Data

Figure G-1. Changes in mean gradient from mouth of Camp Creek to River Mile 4.5

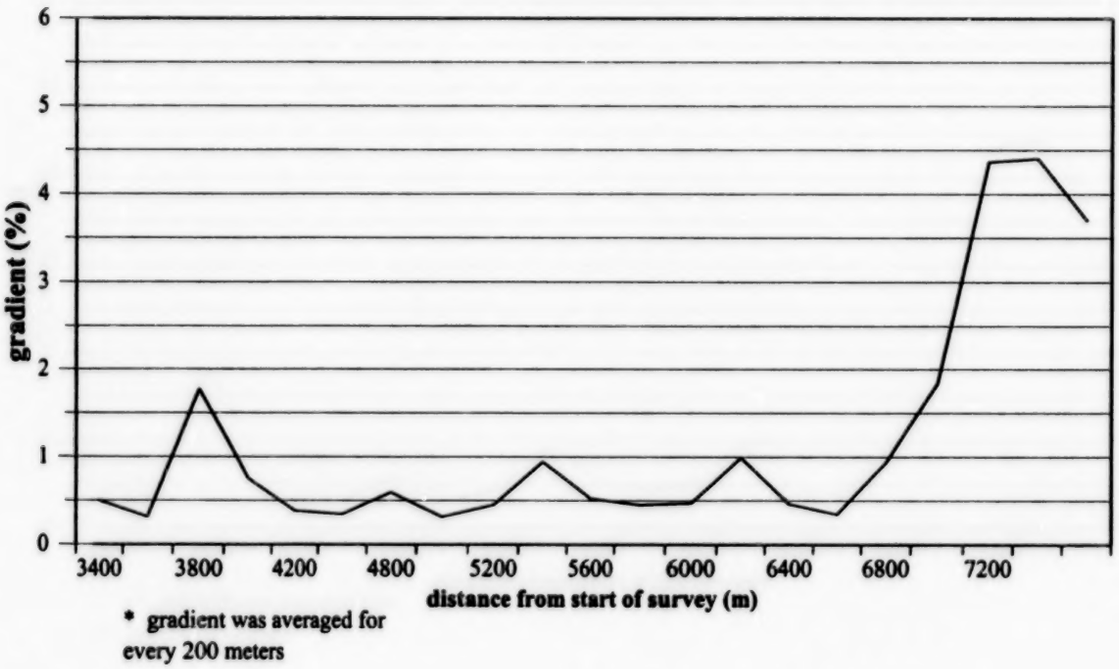

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Figure G-2. Pool Riffle Ratio for Camp Creek

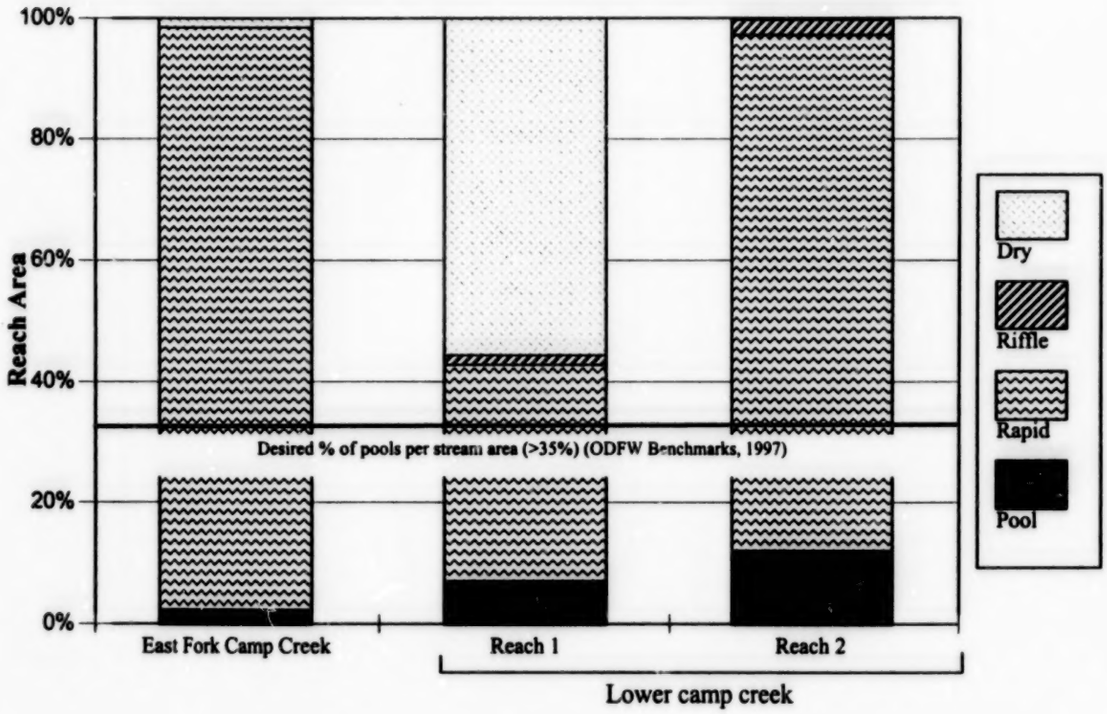

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Figure G-3. Percentage of Substrate Composition from Mouth of Camp Creek to East Fork

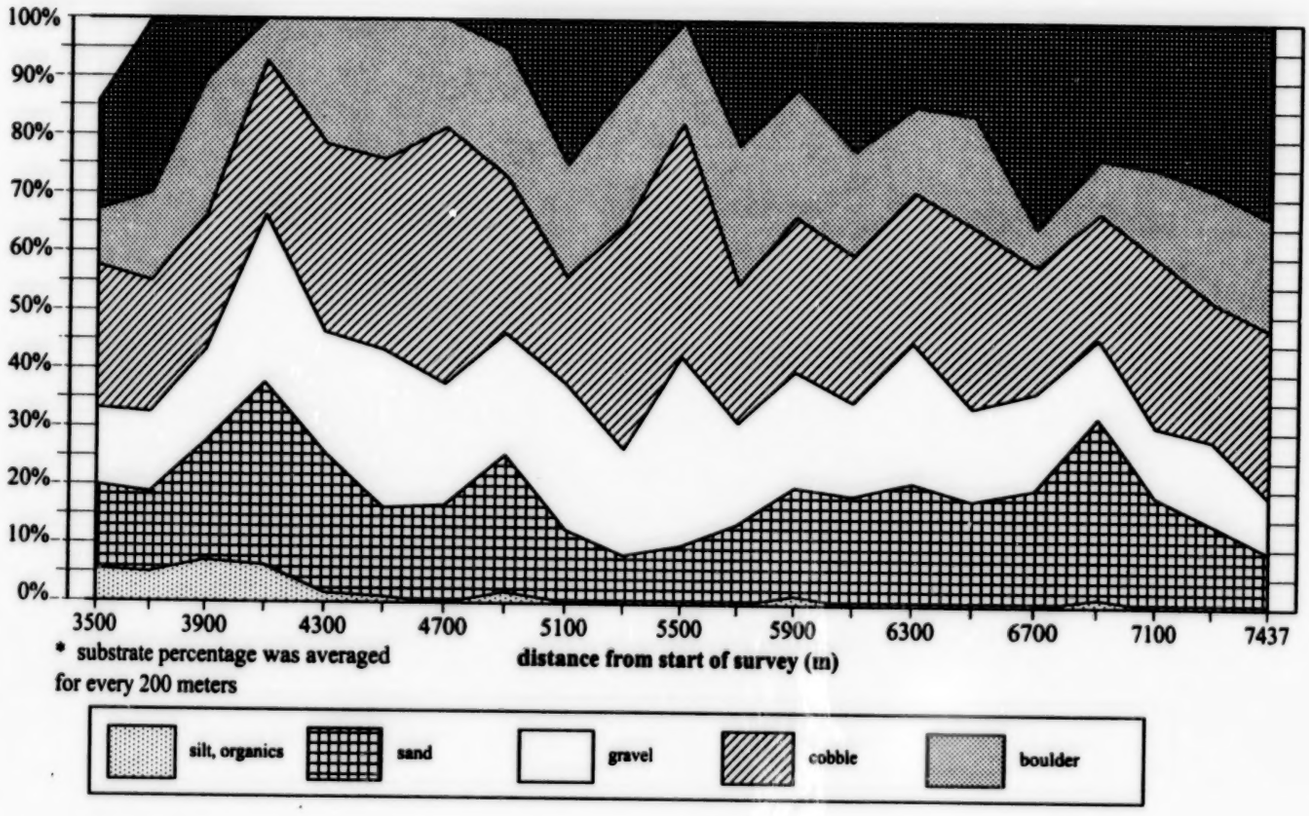

Figure G-4. Amount and Size of Coarse Woody Debris in Camp Creek

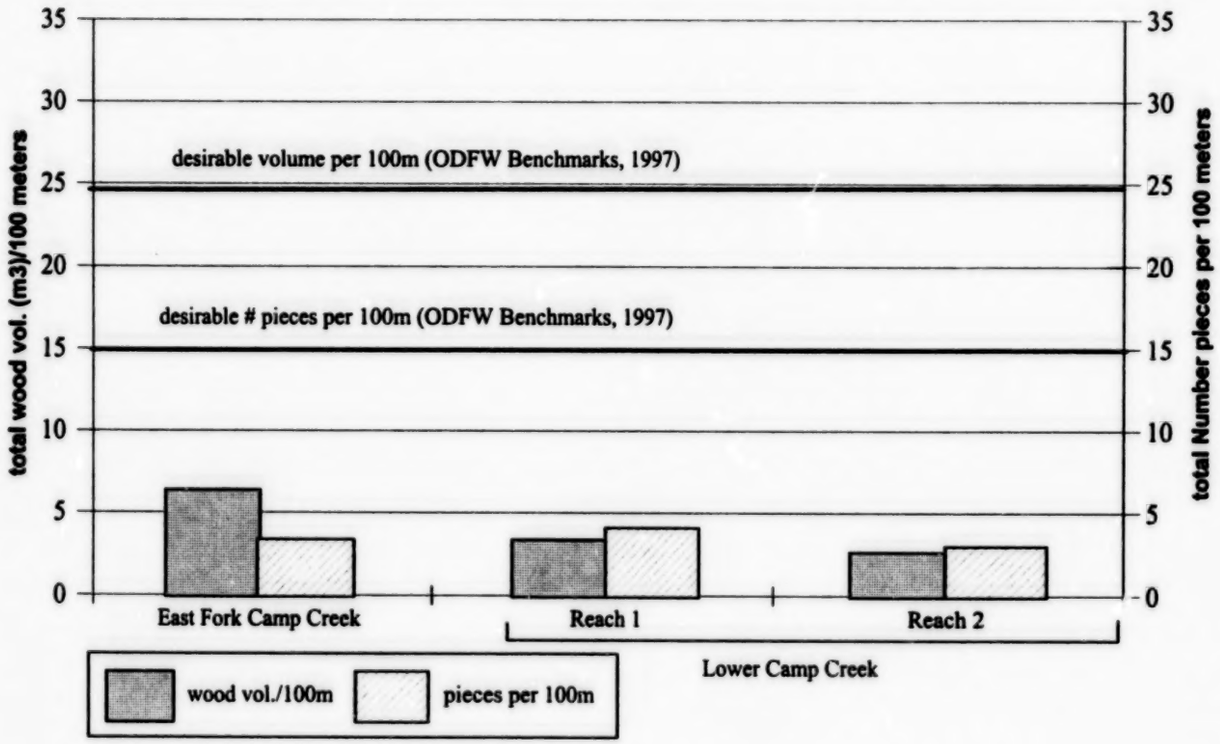

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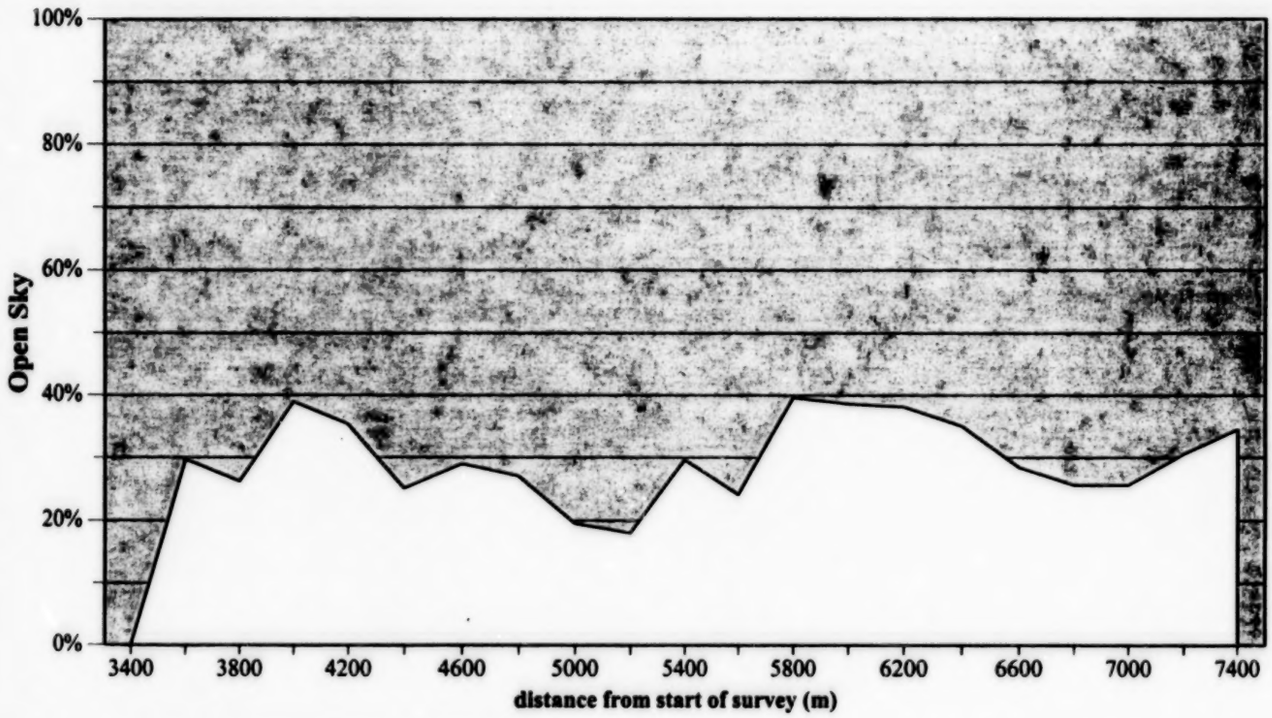
Figure G-5. Percent of Open Sky-Lower Camp Creek



* Open Sky percentages were averaged for every 200 meters.

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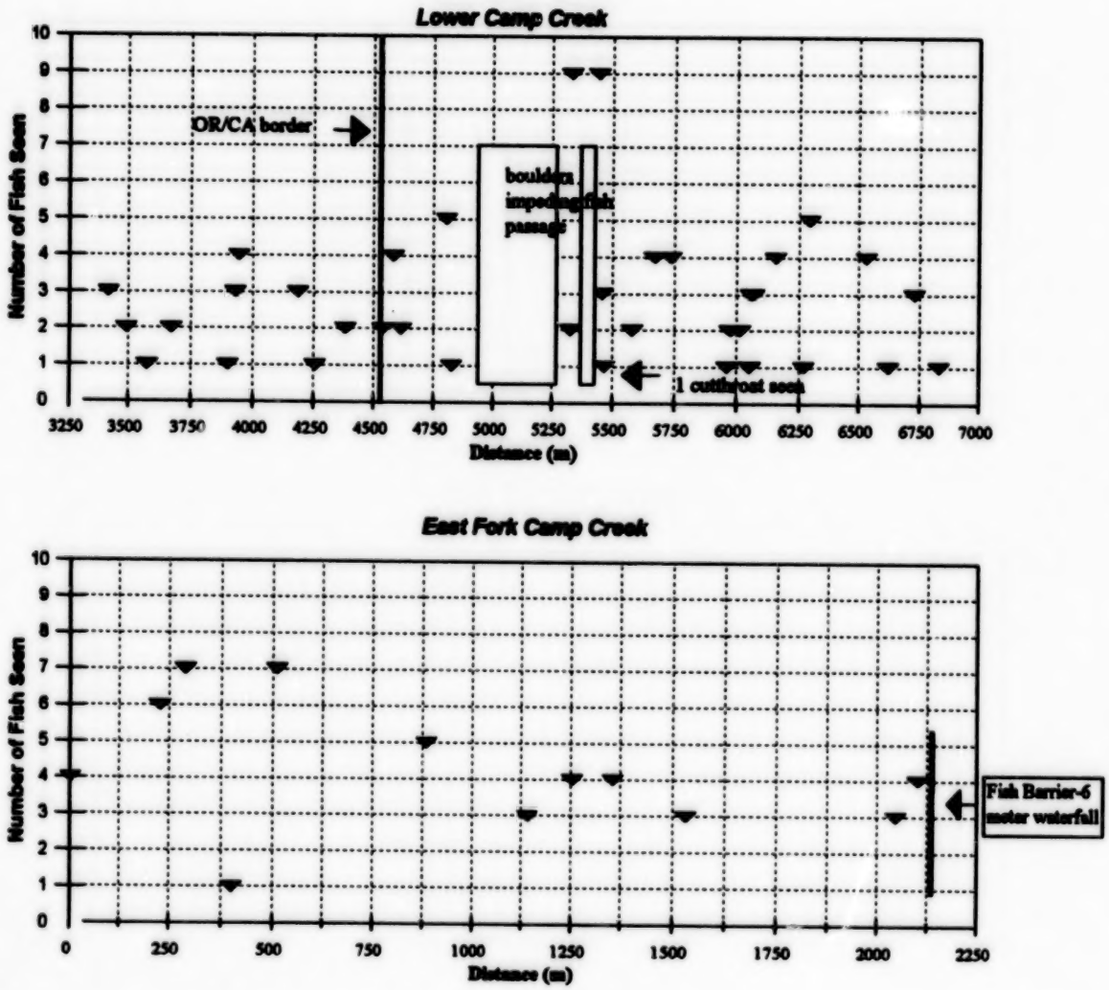
Figure G-6. Frequency of Fish Observations in Camp Creek



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APPENDIX H
Schoheim Road Issues and Options

ISSUES

A. Sedimentation
B. Wildlife (deer winter range)
C. Fire access (from the ground)
D. Fire risk (human-caused ignition)
E. Administrative access
F. Recreation - motorized use (includes hunting)
G. Recreation - non-motorized "wilderness experience"
H. Noxious weeds/pathogens
I. Hydrology - disruption of flow patterns that affect plant moisture regimes
J. Large "undisturbed" natural area

MANAGEMENT OPTIONS

1. Seasonal closure during the wet season.
2. Permanent closure/decommission (i.e. rip, waterbar, outslope, seed, mulch, and plant trees) of the entire Schoheim Road.
3. Permanent closure/decommission of the portion of the road where it is causing high sediment levels (Camp Creek).
4. Surface and maintain the road to keep open year-round.
5. No change in management.
6. Replace road with trail for non-motorized access.
7. Close road to larger 4x4 vehicles but keep open for ATVs and motorcycles.
8. Regulated use closure (e.g. gate with key check-out).
9. Decommission the road from the ridge between Cottonwood and Klamath-Iron Gate Watersheds to the ridge between Klamath-Iron Gate and Jenny Creek Watersheds.
10. Road maintenance (improve drainage).
11. Road obliteration.

ISSUE/OPTION MATRIX

The following matrix identifies the road options that would help resolve each issue identified for the Schoheim road. The watershed analysis team rated each road option on how well it would address the issues. If a particular option would benefit the issue it was given a 2 rating but if it would only partially address the issue, it was given a 1 rating. Combinations of options were also rated.

Schoheim Road Issue/Option Rating Matrix															
Road Issue	Road Options														
	1	2	3	4	5	6	7	8	9	10	11	1&10	6&10	7&10	8&10
A		2	2	2					2	2	2	2	2		2
B	2	2	2			2		2	1		2				
C	2			2	2			2		2					
D		2	1			1		2	2		2				
E	2		1	2	2		2	2		2					
F	2		1	2	2		2	2	1	2					
G		2	1			2			2		2				
H	1	2	1			1		1	2		2				
I		2	1	1					2	2	2	2	2	2	2
J		2	1						2		2				

The watershed analysis team used this matrix to form the Schoheim road alternatives in the Management Objectives and Recommendations section.

APPENDIX I
Fifteen Percent (15%) Late-Successional Retention Areas

The Northwest Forest Plan (NFP) recognizes the value of remnant late-successional (mature/old-growth) forest stands for their biological and structural diversity and for their function as refugia for old-growth related species. The 15 percent Standard and Guide (S&G) in the Record of Decision (ROD) for the NFP addresses the retention of these forest stands on a fifth-field watershed scale (e.g., Klamath-Iron Gate watershed) (USDA and USDI 1994, p. C-44). The S&G basically states that at least 15 percent of the forested landbase in the watershed should be comprised of late-successional forest. The NFP federal executives, with the assistance of the Regional Ecosystem Office (REO), developed a process to assess what action(s), if any, should be taken to meet the 15 percent S&G.

As part of the Third Year Review of the Medford District Resource Management Plan (RMP), all fifth-field watersheds in the district were assessed using the process developed by the NFP executives. For the analysis of the Klamath-Iron Gate watershed and other watersheds within the administrative boundary of the Ashland Field Office, late-successional forest was defined as that which provides suitable habitat for northern spotted owls. Suitable northern spotted owl habitat provides for nesting, roosting, or foraging by owls, and generally has the following attributes: high degree of canopy closure (approx. 60%+), multilayered canopy, presence of large snags and coarse woody debris.

The results of the analysis for the Klamath-Iron Gate Watershed follow:

Forested Landbase (Acres)	Existing Late-Successional Forest (Acres)	Late-Successional Forest Available for Harvest (Acres)	Late-Successional Forest to be Retained (Acres)	Percent of Forested Landbase Comprised of Late-Successional Forest to be Retained
4,501	1,939	32	1,908	42.4

As shown in the table above, there are 4,501 acres in the forested landbase, and of that, 1,939 acres are late-successional forest. Of the 1,939 acres of existing late-successional forest, only 32 acres are available for future timber harvest. The remaining 1,908 acres of late-successional forest will be retained due to land allocation and management constraints, e.g., riparian reserves, Soda Mountain Wilderness Study Area, and Cascade/Siskiyou Ecological Emphasis Area. The acreage of late-successional forest to be retained comprises 42.4 percent of the forested landbase; therefore the 15 percent S&G is achieved in the watershed without further action. The late-successional forest stands that will be retained are shown on Map 21.

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APPENDIX J

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Oregon State Office
P.O. Box 2965 (1300 N.E. 44th Ave.)
Portland, Oregon 97208

In Reply Refer to:
5400 (931)

November 29, 1994

Instruction Memorandum No. OR-95- 028
Expires 09/30/96

To: District Managers: Salem, Eugene, Roseburg, Coos Bay, Medford, and Lakeview

From: State Director

Subject: Implementation of Coarse Woody Debris Standards and Guidelines

The Regional Ecosystem Office (REO) has provided guidance from the Research and Monitoring Committee (RMC) for implementation of the Coarse Woody Debris (CWD) Standards and Guidelines (S&G). These guidelines apply for regeneration harvest and partial harvests (Record of Decision, C-40).

The Special Provision for regeneration harvest should read as follows:

> "A minimum of (120) (240) linear feet of logs per acre, averaged over the cutting area and reflecting the species mix of the unit, will be retained in the cutting area as shown on Exhibit A. All logs shall have bark intact, be at least (16) (20) inches diameter at the large end, and be at least (16) (20) feet in length. Logs shall be distributed throughout the cutting area, and not piled or concentrated in a few areas. Where logs are available and safety considerations permit, a minimum of (based on ID Team recommendation) linear feet of logs shall be retained on each acre of the cutting unit as directed by the Authorized Officer."

Apply the first set of specifications (120 linear feet; 16 inches; 16 feet) to sales south of the Willamette National Forest and the Eugene BLM District, or east of the Cascades. Apply the second set of specifications (240 linear feet; 20 inches; 20 feet) to sales north of and including the Willamette National Forest and Eugene BLM District.

The RMC recommended that the minimum linear feet to be retained on each acre be established by an interdisciplinary team (ID Team) based on the availability of CWD and the

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site conditions. This approach was identified as consistent with the objectives of the S&G and several related S&Gs. We recommend that steepness of slopes and stand density be considered in arriving at a reasonable and attainable minimum.

The Special Provision for partial harvest should apply the same basic principles, but they should be modified to reflect the timing of the stand development cycles where partial harvest is practiced. The RMC specified that:

1. The application is difficult in stands being thinned or in density management prescription implementation when harvest trees are generally less than 18-20 inches DBH.

2. The ID Team should modify the guidelines based on the timing of stand development and site conditions, including current CWD, availability of logs, and future production of CWD.

3. It is not necessary to fall reserve trees to provide down logs. Reserve trees provide opportunities to meet snag and CWD objectives later in the rotation.

A copy of the REO correspondence, which is the basis for our guidance, is attached for your reference.

Daryl L. Albiston
Acting Associate State Director

1 Attachment
1 - REO memo to BLM dated 10/13/94 (4 pp)

Distribution
WO-230 (Room 204 LS) - 1
OR-930 - 1
OR-931 - 1

REGIONAL ECOSYSTEM OFFICE

P.O. Box 3623
Portland, Oregon 97208
(503) 326-6265
FAX: (503) 326-6282

MEMORANDUM

DATE: October 13, 1994

TO: Don Knowles, Executive Director

FROM: Dan McKenzie, Research and Monitoring Committee

SUBJECT: Review of BLM's Interpretation of Standards and Guidelines for Retention of Coarse Woody Debris.

As requested in your letter of September 6, 1994, the RMC has reviewed BLM's interpretation and suggests an alternative contract provision that is consistent with BLM's proposal and the intent of the Coarse Woody Debris (CWD) Standards and Guidelines (S&G) for regeneration harvests (ROD, C-40). We intend that this example contract provision for retention of 120 linear ft. per acre is applied to sales south of the Willamette National Forest and the Eugene BLM District, or east of the Cascades. For areas north of and including the Willamette National Forests and Eugene BLM District, the length (240 ft.) and diameter (20 in.) requirements remain the standard and would modify the contract provision when applied to those areas. Further, the RMC noted that no distinction was made (in the August 23, 1994 letter) between the contract provision for regeneration harvest and partial harvests. The RMC interpreted the sample contract provision as proposed to be applied only to regeneration harvest related sales and that appropriate modifications would be made for partial harvests. A short note appears at the end of this letter that provides additional material for consideration when implementing the CWD S&G to partial harvests.

The objective of the coarse woody debris standard is to assure that minimum levels of CWD are retained "well distributed across the landscape" and "for maintaining populations of ... organisms that use this habitat structure" (ROD, C-40). The linear feet of logs standard was not meant to apply as an exact amount on each individual acre (Starkey and Tappeiner, pers. comm. 9/94). It is recognized that site characteristics will result in more coarse woody debris in some areas of the cutting unit than others, which is not inconsistent with the intent of the S&G. However, the intent is that logs will be well distributed and it will not be appropriate to concentrate material in a few locations within the cutting unit.

We propose the following alternative to your proposed example contract provision for a 10-acre regeneration harvest sale:

> "A minimum of 120 linear feet of logs per acre, averaged over the cutting area and reflecting the species mix of the unit, will be retained in the cutting area as shown on Exhibit A. All logs shall have bark intact, be at least 16 inches diameter at the large end, and be at least 16 feet in length. Logs shall be distributed throughout the cutting area, and not piled or concentrated in a few areas. Where logs are available and safety considerations permit, a minimum of 50 linear feet of logs shall be retained on each acre of the cutting unit as directed by the Authorized Officer."

Our recommendation is based on examination of three aspects of the CWD S&G: 1) average over cutting unit versus amount per individual acre, 2) minimum diameter of logs, and 3) minimum linear feet on any individual acre.

1. Use of an average per acre over the unit, or total across the unit, as the measurement to determine compliance with the S&G for CWD is consistent with the scientific author's intent (Starkey and Tappeiner, pers. comm. 9/94). In addition, it is consistent with the CWD S&G's for northern California National Forests as prescribed in the ROD C-40, and described in the Draft Forest Plans. As an example, the Mendocino NF Plan is: "Maintain a minimum of three recently-downed logs per acre, averaged over 40 acres." (IV-37) Further, the average per-acre measurement is consistent with the closely associated Standard and Guide for snag retention: "with per-acre requirements met on average areas no larger than 40 acres" (ROD, C42).

2. The proposal to measure the log diameter at the small end, while consistent with the CWD S&G, is a more restrictive requirement than measurements at the large end. Measurements at the large end are designated for the northern California National Forests, draft Forest Plans: "greater than 20 inches in diameter (large end)" (Mendocino NF Draft Plan IV-37). The RMC concluded that the log diameter requirements of the S&G could be met by a uniform approach of measuring the CWD logs at the large end.

3. The RMC recommends that the "minimum ... on each acre," be established by the interdisciplinary team to reflect availability of CWD and site conditions. While not explicitly required by the CWD S&G, providing a minimum per acre is consistent with the objectives of the S&G and several related S&G's. Examples of related S&G's are: "maintain 5 to 20 pieces of coarse woody material per acre," (Klamath NF Draft Plan, 4-19) and "4 to 6 logs," (Shasta-Trinity National Forest Draft Plan, 4-45). The RMC does not consider the current proposal of "a minimum of fifty(50)" to be a recommendation to establish a new minimum CWD S&G.

REGIONAL ECOSYSTEM OFFICE

P.O. Box 3623
Portland, Oregon 97208
(503) 326-6265
FAX: (503) 326-6282

MEMORANDUM

DATE: October 13, 1994

TO: Elaine Zielinski, BLM State Director OR/WA

FROM: Donald R. Knowles, Executive Director Donald Knowles

SUBJECT: Interpretation of Coarse Woody Debris Requirements in the Record of Decision (letter of August 23, 1994)

By letter of August 23, 1994, you requested concurrence by the Regional Ecosystem Office (REO) with the Bureau of Land Management's interpretation of the Coarse Woody Debris (CWD) requirements in the Record of Decision.

The REO referred your request to the Research and Monitoring Committee (RMC) for review of the CWD Standards and Guidelines (S&G). The RMC has completed it's review of the proposed contracts provision and their report is enclosed.

The RMC report provides a clarification of the method of measurement for complying with the Standards and Guides. The RMC also directs your attention to the differences in the CWD S&G for regeneration harvests and partial harvests.

Should you desire further assistance on this matter, please feel free to call either myself or Dan McKenzie (503-326-6350).

Enclosure

cc:
Mike Crouse

OR910 ROUTING:
(10/17/94 -DKnowles)
OR910-SD
OR910.1-ASD
OR912-PA
OR913-EEO
OR914-RP/LE
OR920-MIN
OR930-LRR
OR940-OPS
OR950-ADM
OR955-RMU 1730
W. DISTRICTS
E. DISTRICTS
OTHER:

X=Action / C=Copy

Attachment

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Coarse Woody Debris Standards and Guidelines for partial harvest.

> "In areas of partial harvest, the same basic guidelines should be applied, but they should be modified to reflect the timing of the stand development cycles where partial harvest is practiced" (ROD, C-40).

We recognize that interpretation of these guidelines is difficult for stands which are being thinned or in which density management prescriptions are being implemented, especially when the harvested trees are generally less than 18 to 20 inches DBH. In partial harvest situations, the interdisciplinary team should modify the guidelines based on timing of the stand development and site conditions, including current CWD, availability of logs, and future production of CWD.

During partial harvest early in the rotational cycle, it is not necessary to fall the larger dominant or codominant trees to provide logs. These trees will provide opportunities for CWD later in the rotational cycle, plus as these larger trees die from natural mortality, some can be retained to provide snags and future CWD.

APPENDIX K

UNITED STATES DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT
Oregon State Office
P.O. Box 2965
Portland, Oregon 97208

In Reply Refer to:
5400 (OR-931)

November 19, 1996

EMS TRANSMISSION 11/20/96
Information Bulletin No. OR-97-064

To: District Managers: Coos Bay, Eugene, Lakeview, Medford, Roseburg, and Salem

From: State Director

Subject: Implementation of Coarse Woody Debris Standards and Guidelines

Instruction Memorandum No. OR-95-028 dated November 29, 1994, provided guidance for the implementation within Matrix management lands of coarse woody debris (CWD) Standards and Guidelines (S&Gs) (pp. C-40 and 41 of the Northwest Forest Plan). As we continue to gain experience working with CWD on the ground, various prescriptions have been developed and clarifications requested for their use.

This Information Bulletin discusses options and clarification for the following CWD features:

- Retention of existing CWD:
- Crediting linear feet of logs;
- Crediting of large diameter short piece (less than 16/20 feet) logs by using a cubic foot equivalency alternative;
- Standing tree CWD retention versus felling to provide CWD substrate:
- Application of the basic guideline in areas of partial harvest.

The information contained in this bulletin may be used for the design and layout of Matrix harvest sales: however, proposed timber sales where layout has been completed need not be modified. Resource Management Plans may limit the implementation of some of these recommendations. This Information Bulletin has been shared widely with other agency specialists and a copy has been provided to the Regional Ecosystem Office (REO). We are forwarding the attached discussion paper for information and detail on how various resource areas have dealt with CWD issues.

The development of models for groups of plant associations and stand types to be used as a baseline for prescriptions within specific geographic areas is encouraged (S&Gs at C-40.

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Part A, and C-41, Part E). The desired conditions should address both sustainable ecological and biological conditions, even providing habitat beyond natural conditions. Some working "CWD" and "desirable condition" definitions are given in the Appendix: historical ecological condition, species-specific biological condition, and desired future condition. Taking advantage of opportunities "to provide coarse woody debris well-distributed across the landscape in a manner which meets the needs of species and provides for ecological functions" should be captured in your local prescriptions.

If you have any additional questions, please contact Larry Larsen at 503-952-6080 or Nancy Anderson at 503-952-6072.

Signed by
A. Barron Bail
Acting Deputy State Director for
Resource Planning, Use & Protection

Authenicatedby
Maggie Weaver
Management Asst.

1 Attachment
1 - Questions & discussion re S&Gs
for coarse woody debris (8 pp)

Distribution
WO-330 (Room 204 LS) - 1
OR-930 - 1
REO (Knowles, Pietrzak) - 2

Questions and Discussion Regarding Standards and Guidelines to *Provide specified amounts of coarse woody debris in matrix management.*

This paper discusses the implementation of the Standard and Guideline (S&G) titled ***"Provide specified amounts of coarse woody debris [CWD] in matrix management"*** (S&G C-40 and C-41). The S&G prescribed specific measures (S&G C-40, Part B) which need to be used until geographic guidelines are developed (S&G C-40, Parts A and E). As local knowledge on how best to design timber sales continues to increase, the ways to achieve adequate quantities of CWD are also developing. We have drafted a question-and-answer discussion paper which we believe will be helpful in your implementation of this S&G.

1. QUESTION: Retention and protection of CWD already on the ground was not addressed in Instruction Memorandum No. OR-95-028. Standard and Guideline C-40, Part C, states: "Coarse woody debris already on the ground should be retained and protected to the greatest extent possible from disturbance during treatment which might destroy the integrity of the substrate." Is the priority "to provide" CWD or "to retain" existing CWD? Is it appropriate to remove decay classes 1 and 2 and replace them? How limiting is "protect to the greatest extent possible?" Is the presence or absence of bark, post-logging, the critical indicator of functioning decay class 1 or 2 logs?

DISCUSSION: Logs present on the forest floor prior to harvest generally are providing habitat benefits that will likely continue after harvest. Where practicable, pre-harvest CWD decay class 1 and 2 logs should be reserved (e.g., painted with the reserve color) in adequate quantities to provide the baseline feet requirement; other decay class logs are to be protected to the extent possible. Specified amounts of decay class 1 and 2 logs to be retained is given in C-40, Part B; and suggested locations of retention areas is given in C-41, Part D.

The phrase "protected to the greatest extent possible" recognizes felling, yarding, slash treatments, and forest canopy openings will disturb CWD substrate and their dependent organisms. These disturbances should not cause substrates to be removed from the logging area nor should they curtail treatments. Appropriate protective practices should be addressed during logging design such as locating forest patches to retain logs, use of site preparation techniques, and attention to CWD during contract administration to minimize damage and protect substrate integrity. As a general rule, a reserve clause would be used in the timber sale contract and site preparation activities would be designed to minimize disturbance for all decay classes. During contract administration, our desire to protect these logs to the greatest extent possible should be conveyed to the purchaser.

Following harvest, coarse woody debris should be retained both for the current forest habitat and for the development and function of the next forest. Prescriptions should account for current habitat conditions and the timing and development of subsequent snags and CWD until the next stand once again begins to contribute CWD. Decay

substrates as a group generally persist for hundreds of years. Some CWD last up to 500 years within some forest ecosystems, while in others the life span is as short as 60 years. Advanced decayed material often holds large amounts of water and nutrients and contains the majority of soil horizon ectomycorrhizae. Prescriptions are to provide CWD to a full array of late-successional related species and to ensure soil organic material replacement over the next 100 years.

Prior to removal of any decay class 1 or 2 logs, the Interdisciplinary Team should evaluate the "appropriate coarse woody debris quantity, quality (such as species, decay stage and size) and distribution." Down logs should reflect the species composition of the original stand in order to retain the habitat conditions which would have occurred without harvest. The removal of excess decay class 1 and 2 logs is contingent upon the evidence of appropriately retained or provided amounts of decay class 1 and 2 logs. Large amounts of CWD are naturally and periodically infused into the forest following fires, blowdown, and snow/rain events and provide benefits to late-successional species. "Salvage" of these materials must provide for adequate levels of desirable biological substrates.

The presence or absence of bark has been used as a method to help logging crews distinguish between decay class 2 and 3 logs. Experience has indicated that some surface bark will be dislodged from CWD during felling, yarding, and site preparation. The presence or absence of bark is an important indicator, but not the sole critical indicator. (See structural features associated with decay class logs as given in the Forest Survey Handbook H-5250-1, "A five-class system of log decomposition based on fallen Douglas-fir trees," pp. IV-13/-16. In discussing site preparation, Graham et al. (1994) concluded that fire which charred bark and wood did not interfere substantially with the decomposition or function of CWD.) (Graham, et al., Managing Coarse Woody Debris in Forests of the Rocky Mountains. USDA Res Paper INT-RP-477. 1994.)

Cedar logs, whose wood texture remains decay class 2 for extended periods, tend to accumulate over time. They also tend to lose their bark when, as substrate, they still exhibit decay class 1 or 2 habitat features of structure and texture (i.e., buckskin logs); and their function is that of a decay class 1 or 2 log although bark retention is analogous to that of decay class 3 logs. Post-logging retention, or the removal, of some of these barkless logs is not expected to be critical to the overall function of CWD within a sale unit.

2. QUESTION: Specific amounts of decay class 1 and 2 logs are required following regeneration harvest (S&G C-40, Part B); and in crediting linear feet per acre, Instruction Memorandum No. OR-95-028 stated minimum diameter logs may be measured at the large end. For minimum diameter logs, what length can be credited as a piece to meet the linear feet CWD requirement?

DISCUSSION: In the case of minimum diameter-sized logs (16 or 20 inches at the large end), one minimum piece length (16 or 20-foot section) beyond the minimum diameter may be credited. Bucking tree lengths into sections is not the intent of this clarification or the S&G; long log lengths are preferable.

3. QUESTION: Large diameter, short piece length decay class 1 and 2 logs are being removed from units; and small diameter, adequate length logs are being retained. Can a volume equivalent to 20 inches x 20 feet, (i.e., logs greater than 40 cubic feet) be used to retain large diameter piece logs by crediting their footage toward meeting the linear feet of logs per acre requirement? (See Table 1)

DISCUSSION: An appropriate quantity and quality of CWD must be provided, and the specific measure states "Logs less than 20 [or 16] feet cannot be credited toward this [required minimum] total" (S&G C-40, Part B). Lacking those logs, the general rule is to retain the best material available.

We believe the specific measures are a baseline. We can use the specific measure to develop prescriptions for the retention of CWD. Larger CWD is important for the development and function of both the current and next forest; and because large diameter pieces of CWD have more durable heartwood than small pieces, they last longer. Large logs are a key habitat component for many forms of wildlife; and by disrupting air flow and providing shade, they insulate and protect various forest species.

In many cases, large diameter logs which are the result of felling breakage during logging are removed, and then much smaller diameter logs are left on the unit to meet CWD requirements. Large diameter log sections often possess desirable CWD characteristics such as having more heartwood than smaller pieces. Yet, under the S&Gs, these pieces would not "count" because they are less than 16/20 feet long. Based on field examination, some biologists recommend the retention of these large diameter, shorter length logs. If these segments provide the desired CWD form and function despite the fact that their length is shorter than the specified minimum, they may be counted towards the linear requirement when:

- the large end diameters are greater than 30 inches and log length is greater than 10 feet;
- log diameters are in excess of 20 inches and volume is in excess of 40 cubic feet; (see attached table)
- they are the largest material available for that site.

4. QUESTION: When adequate amounts of pre-logging CWD are lacking, is it okay to provide standing green trees versus immediately felling trees during the regeneration harvest to meet the decay class 1 and 2 log specific measures, at least in the short term?

DISCUSSION: The standard is "[m]anage to provide a renewable supply of large down logs well distributed across the matrix landscape in a manner that meets the needs of species and provides for ecological functions." It is also recognized that "scattered green trees will provide a future supply of down woody material . . . " The specific measures are to provide a supply of decay class 1 and 2 logs at the time of regeneration (and partial) harvest.

It is essential that at the time of regeneration harvest (and partial harvest) provisions be in place to ensure the supply of adequate amounts of CWD. In most cases, the required CWD amounts should be either reserved existing CWD or retained felled logs. (The original memorandum contained a special provision to be used for sales where the purchaser would "select" CWD to be left.) The strategy for CWD should be clearly documented during the planning process.

Experience suggests when tree sizes, disturbance history, and regeneration-harvest stand scheduling does not provide adequate down woody debris, the deficiency, including total absence, of decay class 1 and 2 logs could be corrected by marking additional standing trees and leaving them standing for a period following harvest. This could be accomplished by augmenting the Bureau of Land Management's scattered green tree retention (C-41) requirements. The additional trees would initially be left standing.

If the S&Gs require that 6-8 green trees per acre be retained, prescriptions would require that additional green trees be marked for retention and protection during sale preparation. Adequate potential trees would be retained whether these trees are to be felled or left as green trees for future down woody debris. By reserving all or a portion of decay class 1 and 2 logs, and additional standing trees as described above to correct any deficit, new contract language would not be needed. Operationally, some reserved green trees will be knocked down or felled during the course of logging operations.

Four scenarios have been proposed and recommended to provide the decay class 1 and 2 material by utilizing standing CWD trees:

Scenario 1. Blowdown commonly occurs and wind normally fells retention trees, providing both snags and down CWD immediately following regeneration harvest. After two winter seasons, wind-firm trees may still be standing; top snap occurs providing both snags and CWD; and blowdowns include total tree length, often with the root wad attached. A third year assessment would monitor for CWD and determine if the need exists to fell trees to meet the required linear feet.

Scenario 2. In small diameter regeneration harvest stands, the largest sized green trees are selected as CWD trees and felled following harvest. The alternative is to allow these trees to remain standing and potentially to grow into larger sized diameter CWD substrate after a reasonable period of time. The treatment is similar to partial harvest or commercially thinned units (see Question 5). To date, green tree CWD retention prescriptions have included some or all of the following elements:

- retain the largest sized diameter trees for required green leave trees;
- immediately post-harvest, ensure that enough logs are on the ground to meet one-half the CWD requirement;
- designate additional standing green trees to grow larger diameter trees;
- CWD green trees would be left standing for a period of time, 5-15 years, until they attained the desired larger size or succumbed to natural mortality. The necessary window to grow and provide the specified amount of CWD could be as long as 30 years.

Scenario 3. The strategy is to meet the decay class 1 and 2 log level required post-harvest immediately following logging or the site preparation treatment period. This strategy assumes that an adequate number of reserve trees are retained to meet the requirement. Upon completion of harvest, the existing linear feet of decay class 1 and 2 logs for each sale unit are tallied; and then the reserve trees are felled to meet the 120/240 linear foot requirement. Knockdowns, trees felled to alleviate a logging concern, and blowdowns are counted toward the total linear feet so long as they meet the decay class, diameter, and length requirements. The minimum amount of CWD linear feet are ensured, and excess trees continue to grow.

Scenario 4. Provide the full requirement of CWD logs in reserve trees. There is no need to measure linear feet since the decay class 1 and 2 requirements will be met from the standing, reserved trees. Accept whatever linear feet of decay class 1 and 2 logs is present on the unit post-harvest. It may range from zero to several hundred linear feet. The management action will be to allow natural forces (primarily, windthrow) to provide infusions of trees into CWD decay classes 1 and 2 over time from the population of marked retention trees and snag replacement trees. The option remains to revisit the site over time to monitor decay class 1 and 2 conditions and consider whether elective felling of selected retention trees is warranted. Note that any trees marked as replacement trees to correct snag deficiencies in the short term (three decades) may not count toward the standing retention tree requirements and may not be felled to account for the decay class 1 and 2 logs.

5. QUESTION: "In areas of partial harvest the same basic guidelines are to be applied, but they should be modified to reflect the timing [of] stand development cycles where partial harvesting is practiced" (S&G C-40, Part B). Does this mean we should be felling trees to provide CWD in selection and commercial thinning areas?

DISCUSSION: An accumulation of CWD should be designed into partial harvest prescriptions to provide a natural or biologically desired condition. The timing of stand development cycles providing snags and subsequent CWD from natural suppression and overstocking mortality should be accounted for, the desired conditions estimated, and then the advantages of treatment to improve habitat conditions beyond natural conditions should be assessed. The amounts of CWD should be specifically provided, including felling trees, to meet the desired conditions for late-successional forest related species. CWD trees are not normally required to be felled during harvest, especially trees with broken tops, advanced decay, or other deformities contributing habitat structural features. Leaving naturally dense clumps around snags to provide suppression mortality, scattering "structural" green trees, and allowing individual trees to grow into larger sized CWD materials should be considered in partial harvest plans. Leaving green trees and felling to provide a source for CWD should be part of the partial harvest prescription. The intent is to provide a source of "coarse woody debris well distributed across the landscape in a manner which meets the needs of species and provides for ecological functions."

Appendix
Working Definitions

Coarse Woody Debris (CWD):

The portion of a tree that has fallen or been cut and left in the woods. Usually refers to pieces at least 20 inches in diameter (ROD Glossary F-4).

Coarse Woody Debris (CWD) or Down Woody Debris (DWD):

Any large piece of woody material having a diameter greater than 10 cm (4 inches) and a length greater than 1.0 meter (39 inches)[1]. Fifteen to twenty percent ground cover of DWD or 4.5-10 tons of fresh DWD would be adequate after timber harvesting for optimal amounts of small mammal habitat and organic matter[2].

Desired Condition (DC):

Structural characteristics of late-successional forest vary with vegetation type, disturbance regime, and developmental stage. The desired condition also varies whether the target is a "natural" desired condition or a "biological" desired condition.

Historic Ecological Conditions (HEC):

This term is used to describe a set of ecological conditions that were likely present prior to European influence on the landscape. One of the assumptions was that during this time period natural processes and functions were occurring under inherent disturbance regimes, and thus these represent sustainable conditions. A description of these conditions is usually synonymous with the natural or historic range of variability and focuses on maintaining ecosystem processes and functions, not necessarily the viability of a particular species.

Species-Specific Biological Conditions (SBC):

This term is used to described a set of biological conditions specific to the viability of a particular species. In particular, this term was used to describe habitat conditions for the northern spotted owl or other late-successional/old-growth forest-related species that may address short-term (up to 50 years) viability concerns. These habitat conditions are not necessarily the DEC and may not be sustainable in the long term (greater than 50 years) due to a variety of potential disturbances.

Desired Future Conditions (DFC):

This term is used to describe the interaction between HEC, SBC, and any other social issues that may result in deviation from the HEC. For example, the HEC is described for a particular vegetation type and due to the viability concern for northern spotted owl or other late-successional/old-growth forest-related species, the SBC requires a deviation from the HEC. By overlaying the two conditions, the DFC for that vegetation type is then described. In cases where there were no overriding viability issues with any species, the HEC was synonymous with the DFC.

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[1] Society of American Foresters. Forest Ecology Working Group Terms. 1996.

[2] Carey, A. and M. Johnson: Small Mammals in Managed, Naturally Young and Old-Growth Forests. Ecological Application 5(2): 336-351, 1995; Nakamura, F. And F. Swanson: Distribution of Coarse Woody Debris in a Mountain Stream, Western Cascades Range, Oregon. Canadian Journal of Forestry Research 24: 2395-2403, 1994.

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TABLE 1
VOLUME PER LOG SEGMENT
TAPER PER 16 FEET

Diameter Large End (inches)	Segment Length (feet)								
	20	18	16	14	12	10	8	6	4
20	38.5	35.1	31.6	28.0	24.3	20.5	16.6	12.6	8.5
22	47.1	42.9	38.6	34.1	29.6	24.9	20.2	15.3	10.3
24	56.6	51.5	46.3	40.9	35.4	29.8	24.1	18.3	12.3
26	67.0	60.9	54.6	48.3	41.8	35.1	28.4	21.5	14.5
28	78.2	71.0	63.7	56.2	48.6	40.9	33.0	25.0	16.8
30	90.3	82.0	73.5	64.8	56.0	47.1	38.0	28.7	19.3
32	103.3	93.7	84.0	74.0	64.0	53.7	43.3	32.7	22.0
34	117.2	106.2	95.1	83.8	72.4	60.8	49.0	37.0	24.9
36	131.9	119.5	107.0	94.3	81.4	68.3	55.0	41.5	27.9
38	147.5	133.6	119.6	105.3	90.9	76.2	61.4	46.3	31.1
40	164.0	148.5	132.8	116.9	100.9	84.6	68.1	51.4	34.5
42	181.3	164.2	146.8	129.2	111.4	93.4	75.2	56.7	38.0
44	199.5	180.6	161.4	142.1	122.5	102.6	82.6	62.3	41.8
46	218.6	197.8	176.8	155.5	134.0	112.3	90.3	68.1	45.7
48	238.6	215.8	192.9	169.6	146.2	122.4	98.5	74.2	49.7
50	259.4	234.6	209.6	184.3	158.8	133.0	106.9	80.6	54.0
52	281.1	254.2	227.1	199.6	171.9	144.0	115.7	87.2	58.4
54	303.7	274.6	245.2	215.6	185.6	155.4	124.9	94.1	63.0
56	327.2	295.8	264.1	232.1	199.8	167.3	134.4	101.3	67.8
58	351.5	317.7	283.6	249.2	214.6	179.6	144.3	108.7	72.8
60	376.7	340.4	303.9	267.0	229.8	192.3	154.5	116.3	77.9

APPENDIX L
Guidelines for Use of Native/Non-Native Grass for Site Restoration

The retention of native vegetation types within watersheds should be regarded as a long-term management priority. These sites should be carefully managed to retain native species. Management should embrace two guidelines: (1) to reduce ground disturbing activity of native species habitats to prevent invasion by non-native species, and (2) to promote aggressive integrated weed control programs to prevent encroachment into native species habitat.

The Klamath-Iron Gate Watershed occurs in what is termed a Mediterranean climate. These climates are characterized by cool, wet winters and hot, dry summer months. The lower elevation sites often contain heavy clay soils with high shrink/swell characteristics. Introduced noxious weed species from countries with Mediterranean climates are often "superior competitors" when introduced into native habitats previously not exposed to aggressive competition for moisture and nutrients.

A major portion of the low-elevation habitats in southwestern Oregon are no longer considered native habitats. It is unlikely that these sites will be reclaimed and converted back to native species in the near future, if ever. Higher elevation native habitats should be protected from invasion by limiting ground disturbance and possible exposure to non-natives through aggressive integrated noxious weed control.

Although reclamation using native species is preferred, some sites invaded by non-native species may require intermediate steps in the reclamation process prior to attempting to plant native species. These "site-adopted" non-native grasses would act as an "organic pump" to restore nutrient and soil productivity as well as prevent the "banking" of noxious weed seed in the soil. The long-term goal would be conversion from productive introduced grasses to native species when and wherever feasible.

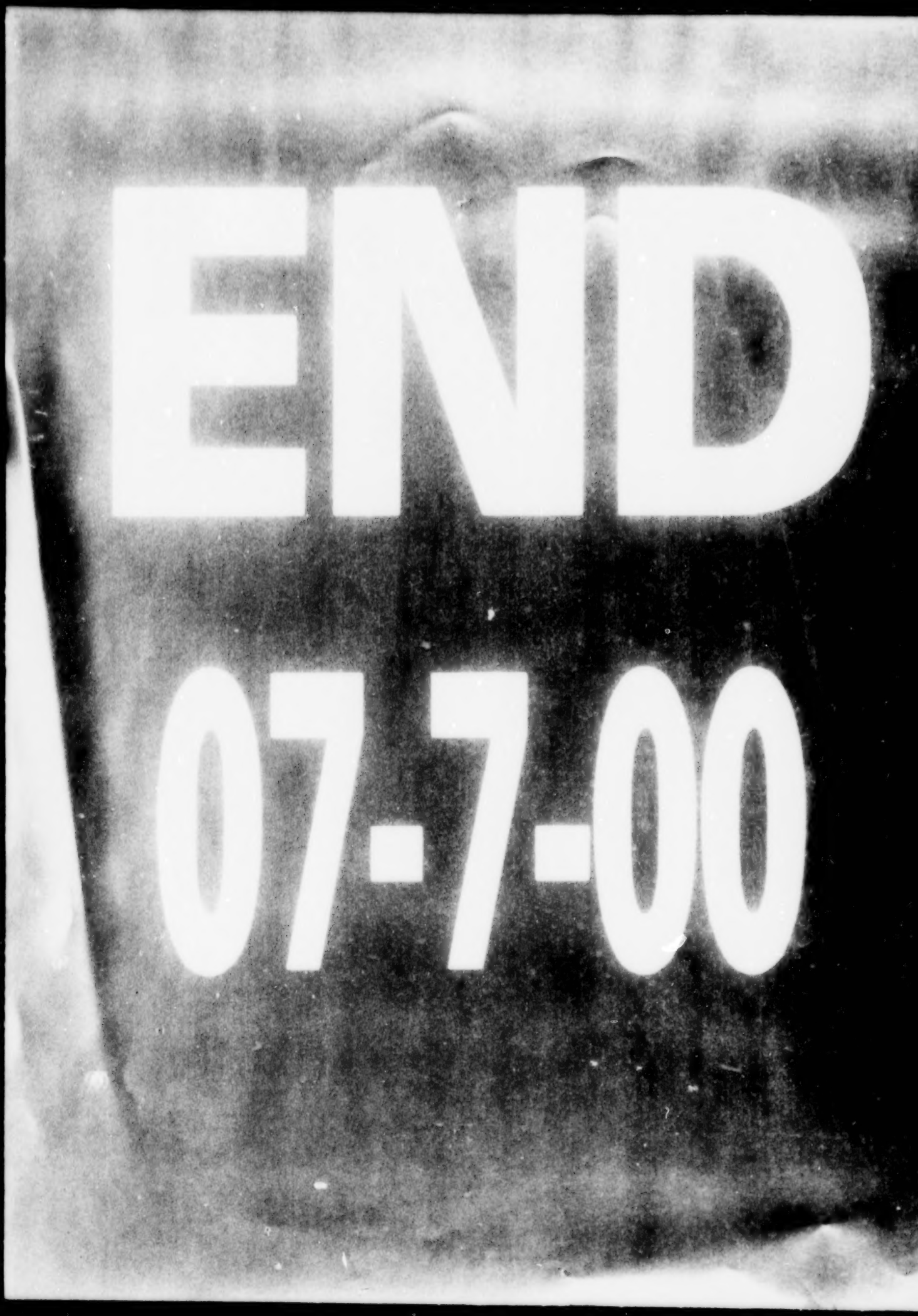
APPENDIX M
BLM Roads of Concern

Objectives: To reduce road density, compacted area, peak flows, sedimentation, and/or roads adjacent to or in Riparian Reserves.
Recommendation: Decommission the following roads.

Road Numbers
Unnumbered road (T.40S., R.4E., Section 35, S1/2)
40-4E-3.0
40-4E-25.0
40-4E-25.2
40-4E-25.5
40-4E-35.1
40-4E-35.2

Objective: To reduce wildlife disturbance.
Recommendation: Block the following roads.

Road Numbers
40-3E-27.0
40-3E-34.0
Jeep road (T40S, R3E, Section 28, W1/2)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